THE STATE
OF THE WORLD's
FOREST GENETIC RESOURCES

COUNTRY REPORT

UKRAINE

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.

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THE STATE OF FOREST GENETIC RESOURCES IN UKRAINE

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EXECUTIVE SUMMARY

Ukraine occupies the area of 603.7 thousand sq.km. As per 01.01.2011, the forest cover of Ukraine is 15.9% (0.2% greater than in 2002).

Forests of limited use cover 50% of the all forest area including 15.4% of reserved forests. About 50% of forests are artificial. Ukraine's forests are predominantely in the State property. The forestry sector in Ukraine economy comstitutes less than 0.4% in its gross domestic product (GDP). The species composition of Ukraine's forests is diverse. More than 30 forest-forming tree species grow in Ukraine's forests.

50 species of tees and bushes are listed in the Red Book of Ukraine [1] including 11 species that are on the European Red List and 5 species that are on the IUCN List. 16 forest tree species are protected at the national level, 1 species at the European level (*Acer stevenii* Pojark.). In addition, it is necessary to assign the conservation status for 4 species. There are 12 naturally growing endemic forest tree species.

Genetic forest resources are very important for the Ukraine's forestry. The state of genetic resources is characterized not only by the presence or absence of particular species, but also by a historically shaped intraspecific structure of the genepool of forest tree species. The conservation of genetic diversity of forest tree species and the use of this diversity are carried out the basis of silviculture and ecology with due regard to different forest types. The forest genetic resources are an important and necessary component of sustainable forest management.

Investigation of the intraspecific and interspecific diversity of forest tree species has been caryed out in Ukraine during 200 years by educational and research institutions. The conservation of genetic resources of forest tree species was realised in the process of tree improuvement programs aimed at increasing of productivity and resistance of forests, felling volumes, volumes of fruiting, harvesting of resins, and at creating of energy plantations and shelter belts under unfavourable climatic conditions.

In Ukraine, a State targeted program "Forests of Ukraine" designed for the years of 2010 – 2015 [2] is now under way, based on principles of sustainable forest mangement and rational use of forests that provides the conservation of forest biodiversity. A sector-specific program of forest seed-growing development for 2010 – 2015 is [3] aimed at increasing of seed base for forest tree species.

In the forest gene resources conservation activity and tree breeding programs development the Ukrainian Research Institute of Forestry and Forest Melioration, Ukrainian Research Institute of Mountain Forestry, National Ukrainian University of Forestry Engineering, National University of Bioresources and Nature Management of Ukraine, Institute of Botany, botanical gardens and other higher educational institution and research institutions participate.

First steps towards the forest tree species genetic diversity conservation were taken in the framework of the creation of provenance test plots for main forest tree species about 100 years ago and with the beginning of the tree breeding works on forest species over 50 years ago (selection of plus trees and forest stands, the improvement of vegetative propagation methods, seed orchards creating technology). Over the last 10 years, in the framework of the international project "Genetic Resources of Broadleaved Species in Southeastern Europe", the inventory of objects of genetic conservation of broadleaved species have caryed out by scientists of the Ukrainian Research Institute of Forestry and Forest Melioration, Ukrainian Research Institute of Mountain Forestry and of their research stations with the assistance of forest enterprises of the State Forest Recourses Agency. The methods of complex assessement of forest tree species gene reserve were elaborated. A multiple-factor index of functionality (MIF) for gene reserve evaluation were proposed and applied in West regions of Ukraine.

The gene resources conservation in Ukraine is regulated by many legislative and standardized documents. The Forest Code of Ukraine of 08.02.2006 is the basic legislative document on forest management. Other legislative documents adopted for the forest sector in elaboration of provisions of the Forest Code regulate various aspects of the process of forest gene resources conservation.

The genepool conservation and reproduction demand the development and implementation of special strategies for certain species or their groups with due regard for local experience and

experience of European countries, and financial support to such work. Apart from this, it is necessary to carry out systematic research on state of the genetic conservation units at least once every 10 years with the use of complex of actual genetic, physiologic, biochemical and biophysical methods.

The level of public awareness in Ukraine the importance of forest gene resources conservation and rational using is unsufficient. Now the current issues are following: proper informative and propagandistic support to measures on forests genepool conservation, use and reproduction. The subject, forms and methods of the forest gene resources conservation have to become a mandatory component of education programmes aimed for specialists in the field of biology, ecology and forestry.

I. INTRODUCTION TO THE COUNTRY AND FOREST SECTOR

Ukraine is situated in the East Europe between 52°20′ and 44°23′ of the north lattitude and 22°5′ and 41°15′ of the east longitude. It extends over 1316 km from the west to the east and over 893 km from the north to the south. The area of Ukraine is 603628 km^2. The most of its territory (95%) belongs to outskirts of the East European plain. There are lowlands (Polissya, the Dnieper region, the Black Sea region) with individual uplands of 300 - 500 m above the sea level (Podillya, the Dnieper region, the Donetsk range and others). In the south of the country there are the Crimean mountains of up to 1545 m high above the sea level (the mountain of Roman-Kosh), in the west there are the Ukrainian Carpathians of up to 2061 m high above the sea level (the mountain of Goverla).

Main water resources of Ukraine are rivers, over 100 of which are above 100 km long. The longest river is Dnieper, which devides the Ukraine's territory into two parts – Left-bank and Right-bank. The most of above-ground water resources belong to the basins of the Black and Azov Seas. Only a minor portion of the territory in the extreme west of the country, on the watershed area of the rivers of San and West Bug, belongs to the basin of the Baltic Sea.

Ukraine is one of the most populated countries of Europe. The total population size makes up 45.7 mln. The density of population is 76.1 men./km^2. The city of Kyiv, Ukarine's capital, is the biggest city with over 2.8 mln. residents. Second to Kyiv, in population size in Ukraine, is Kharkiv with its over 1.6 mln residents.

Ukraine is among the leading countries of the world in terms of resources of mineral raw materials. It occupies only 0.44% of the the terrestrial part of the world with 0.8% of global population and has 5% of global mineral raw materials. The timber complex of Ukraine incorporates the forestry industry, wood-processing industry, cellulose and paper industry, and dendrochemical industry. In Ukraine, there are no considerable forest resources to develop the timber complex, but Ukraine's forests play an important role in climate regulation and water- and field-protection.

Ukraine's biodiversity comprises over 72 thousand species of flore, microbiota and fauna. Flore and microbiota contain over 25 thousand species of plants, mushrooms, slime molds and lichens including 4523 natural flore species of vascular plants (1/3 of European flore), and, together with the most important cultivated species, 5088 species. The forest tree species are component part of biodiversity. Information on genetic resources of these species is presented below.

This report was prepared and writted with the participation of experts from various institutions that are related to the conservation of forest genetic resources in Ukrine, in particular the State Agency for Forest Resources of Ukraine, the State Forest Seed Inspection, research institutions and higher educational institution (Annex A).

1.1. General description of forests

The total area of Ukrine's forest lands is about 10.7 mln. ha of which 9.5 mln. ha are covered with forests, that is 15.7 % of the territory of the country. In terms of forest cover and wood resources, Ukraine belongs to sparsely forested countries of Europe (on the average, there are 0.17 ha of forests and 16.4 m^3 of standing volume per capita).

Over the last 50 years, the forest coverage increased by a factor of about of 1.5, and the standing volume by a factor of 2.5 to reach 1.8 billion m^3. An average annual increase in forests of the the State Agency for Forest Resources of Ukraine makes up 4.0 m^3 per ha and ranges from 5.0 m^3 in the

Carpathians to 2.5 m^3 in the Steppe zone. Forests are widespread in the following physico-geographical and climatic zones: Polissya, Forest-Steppe, Steppe, the Carpathians and Mountaneous Crimea, being different in their species-related and age-related structure, floristic and cenosis-related composition. The main part of forests is concentrated in the Carpathians and on plains of the zone of mixed forests (Polissya) where they cover 37.5% and 29.8% of territory, respectively. Relatively small areas of the Mountaneous Crimea are forest-covered to the extent of 28.7%. Much less forests are located in the Forest-Stepe and Stepe zones. These zones contain only 12.0 and 4.0% of lands covered with forests, respectively.

Forests of Ukraine fall into the following categories according to their ecological and socio-economic importance and their basic functions [4]:

1) protective forests (predominantly functions of water- and soil-protection and other protective functions);

2) recreational and health-giving forests (predominantly recreative, sanitary, hygienic and health-giving functions);

3) forests of environment-oriented, scientific and historical-cultural purposes (special environmentally friendly, aesthetic, science-based functions, etc.);

4) commercial forests.

Forests of limited use make up 50% of the total forest area including 15.4% of forests on conservation districts. About 50% of forest lands are artificial; in the Forest-Steppe and Steppe zones, the portion of artificial forests is far much greater.

Meliorative stands in Ukraine have been created since the 19th century. An expedition of the Forest Department (1892-1899) under the guidance of V.V. Dokuchayev worked out methods for growing forests in the Stepe zone and recommended measures on the development of steppe sylviculture. In today's Ukraine, on the fields of agricultural enterprises there are about 1.4 mln. ha of protective forest stands of various targered purposes including 150 thousand ha of water-protection stands and 440 thousand ha of shelter belts [5].

In today, 15.8% of forests that are under control of the State Agency of Forest Resources belong to the State-owned natural-reserved bank. Over the last 30 years, the area of territories and places of the natural-reserved bank on forested lands increased threefold (these areas increased from 315 thousand ha in 1978 to 1199 thousand ha in 2012, and their share of these in all forest lands from 5.5% to 15.8%, respectively).

1.2. System of forest resources management

The State Forest Resources Agency of Ukraine that governs 68% of State's forests is the central executive authority and ensures the implementation of the State policy in the sphere of forest and hunting sector.

The main tasks of the State Agency for Forest Resources of Ukraine are the follwing:

- making proposals for state policy in the sphere of forestry and hunting sector;
- implementation of the state policy in the sphere of forest and hunting sector .

Forest management at a local level is effected by State forest enterprises that are subordinated to the State Agency for Forest Resources of Ukraine and coordinated by its respective territorial body (Republican Forest Committee of AR Crimea, 24 regional boards of forest and hunting sectors).

The State forest enterprises are responsible for the whole complex of forestry operations - from the planting of forests to harvesting. Apart from the State forest enterprises, research and educational organizations, naturel reserves and national nature parks and other enterprises are directly subordinated to State Agency for Forest Resources of Ukraine. The National University of Bioresources and Nature Management of Ukraine is subordinated to the Cabinet of Ministers of Ukraine.

The present-day organizational structure of forestry management enables the forest sector to perform functions of restoration, protection and conservation to forests and to provide the customers with required forest resources.

The national forest strategy of Ukraine is directed to:

- increasing the area of lands covered with forests to an optimal extent in different natural zones by means of agricultural afforestation and forest cultivation;
- contributing to the conservation of biodiversity and to the improved resistance of forest ecosystems;
- ensuring the productivity of forests and quality of forest products;
- implementing the policy of sustainable forest management and forest utilization.

1.3. Forms of ownership on forests

According to the Land Code of Ukraine adopted in 2001, three forms of ownership are proclaimed in Ukraine: public (state), communal and private. In compliance with Articles 10-15 of the Land Code, the forests of Ukraine may be in private property.

Farmland areas of up to 5 ha may be transferred into private property. Moreover, legal bodies and private persons may acquire areas of abandoned and degraded lands for the purpose of forest cultivation. Stands within populated localities as well as stands that are outside populated localities but belong to objects of communal property are in communal property, except for public and pivate properties. At the moment, public property is predominant in Ukraine (less than 0.1% of forests are in private property and about 2% in communal property). Sate-owned forests have been assigned for permanent use to various ministries and administrations (Table 1).

Table 1. Forest ownership and area (FRA).

Forest ownership	Area (mln. ha)	%
State forest recourses agency	6.84	66
Local authorities	1.29	13
Forests is not available for use	0.78	8
Ministry of Agrarian Policy and Food	0.57	5
Ministry of Emergency Situations	0.22	2
Ministry of Defence	0.17	2
Ministry of Environment and Natural Resources	0.16	2
Other ministries and agencies	0.35	3
Total	11.16	

1.4. Tendencies in the forest sector for forest conservation and forest management.

Since 2000, the economic situation in the forest sector of Ukraine, as in the entire country, began changing for the best. In 2008, however, the forest sector displayed first signs of the crisis. Over 2008-2009, State forest enterprises faced difficulties in selling their wood, with a consequent dicrease in the felling volume and decline in assignments to the state budget and to social funds.

Generally the portion of the forest sector in Ukraine's economy is small – less than 0.4% of GDP. Charges for timber harvesting in State-owned forests makes up about 0.1% of the state budget. The total sum of assigmenets transferred by State forest enterprises to the State budget is practically equal to budgetary expenditures on forest management.

The portion of forest products (mainly, round wood and sawn wood) in the aggregated export is far much greater (1,6 %).

Accorging to general assessments, the forest sector and related sectors of economy give employment to about 1 million residents of Ukraine. Wages of those employed in forestry remain to be below the average wage across the country.

Forest genetic resources play a leading role in meeting the current demand of the country for forest products and services of the forest sector.

The demand for forest-related products and services does not show evidence of essential changes over the last years. The demand for timber of black alder (*Alnus glutinosa* L.) and of European birch (*Betula pendula* Roth.) has slightly increased.

Table 2. The role of forestry in the economy of Ukraine

	2004	2005	2006	2007	2008	2009	2010
Gross domestic product, billion.	318.3	396.0	487.1	656.9	860.7	914.7	1094.6
Scope of works and services in forestry, mln	1594.6	1991.1	2451.1	2956.3	3382.7	3138.1	4097.7
The share of forestry in GDP,%	0.50	0.50	0.50	0.45	0.39	0.34	0.37
The fee for special use of forest resources, mln	0	0	99.1	173.1	213.3	213.3	171.6
The share of forestry in revenue,%	0	0	0.06	0.11	0.09	0.09	0.07
Budget expenditures on forestry million. USD. *	162.9	220.3	299.0	415.8	618.7	610.4	610.4
The share of forestry expenditure budget	0.16	0.16	0.17	0.24	0.24	0.22	0.20
Exports of goods and services, mln. USA	37980.2	40421.5	45873.2	44448.9	63046.2	35602.9	51430.5
including export of wood (44 group of goods), m. USD.	516.4	533.8	602.8	827.0	800.8	669.8	828.0
The share of wood (44 group of goods) in total exports	1.6	1.6	1.6	1.7	1.2	1.7	1.6
Average monthly wages, UAH	590	865	1041	1351	1790	1877	2239
including in forestry	537	721	924	1.198	1453	1552	1787

* considering the cost of forest management, forest education and science

Forest genetic resources play an important role in forestry of Ukraine. The status of forest genetic resources is characterized not only by the presence or absence of particular species, but also by a historically shaped intraspecific structure of the genepool of woody plants. The conservation of intraspecific genetic diversity of forest woody plants and the use of this diversity in Ukraine is effected on the basis of silviculture and ecology with due regard to the forest types. The monitoring of the diversity of populations of woody plants in the primary forest may give us a deeper insight into what is necessary to better cope with the demand for ecosystemic services and benefits.

Forest genetic resources are important components of close-to-nature forest use [6]. The restoration of populations of autochtonous species by a natural way is a basis for the close-to-nature forest management whose concept has been implemented in Ukraine since 2010. The genetic diversity enables native species to survive, adapt and evolve better than introduced species under conditions of climatic changes.

1.5. Environmental conditions of Ukraine

The predominant part of Ukraine's territory is situated in conditions of temperate continental climate, except for the south coast of the Crimea with its Mediterranean type of climate. The degree of continentality goes up in the direction of the west and north-west to the east and south-east.

In Ukraine, one can single out the following natural zones (Fig. 1):

- Temperate forest zone (Polissya).
- Temperate forest-steppe zone.
- Temperate steppe zone.
- Zone of subtropical dry forests (The south coast of Crimea).
- Vertical zoning in the Carpathians and Crimean moutains.

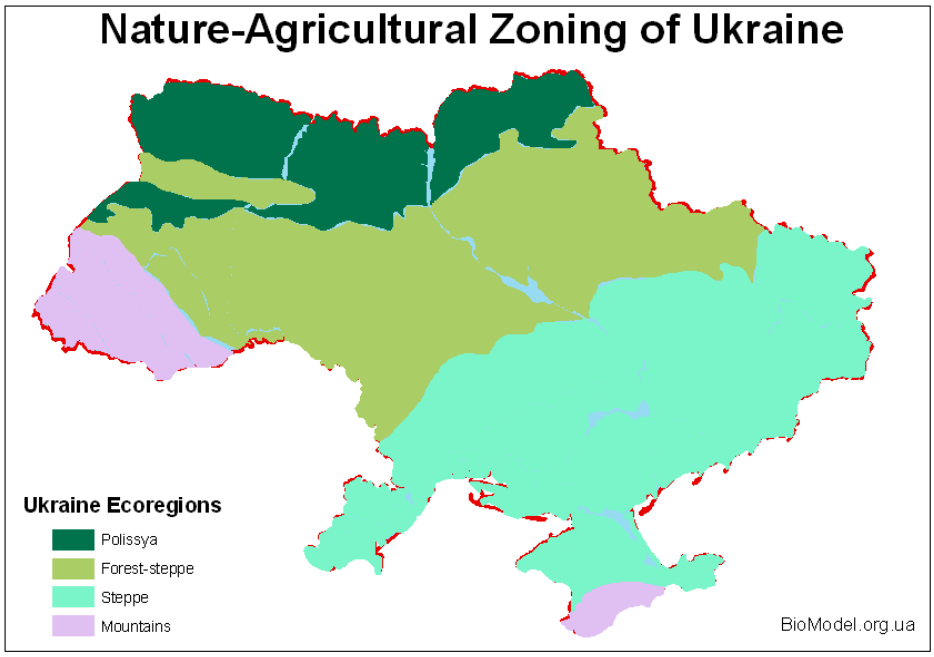


Fig.. 1. Map of natural zones of Ukraine

1.6. Species composition of Ukrainin forests

The species composition of Ukrainian forests is rich and diverse. Over 30 forest-forming woody species grow in these forests. The most widespread edificators and generators of cenosis are Scotch pine (*Pinus sylvestris L.*), English oak (*Quercus robur L.*), durmast oak (*Quercus petraea* L.), European beech (*Fagus sylvatica* L.), Norway spruce (*Picea abies* L.), silver birch (*Betula pendula* Roth or *Betula verrucosa* Ehrh), white birch (*Betula pubescens* Ehrh), common alder (*Alnus glutinosa* (L.) Gaertn.), common ash (*Fraxinus excelsior* L.), hornbeam (*Carpinus betulus* L.), Norway maple (*Acer platanoides* L.), small-leafed lime (*Tilia cordata* L.), common silver fir (*Abies alba* Mill.). In terms of cenosis, the forest vegetation is represented by 28 basic autochtonous and forest formations that have been formed a long time ago [7].

Conifers forests cover 42% of the total forest area, specifically Scoth pine forests covers 33 %, Norway spruce forests cover 8%. There are 5 native species of pines in Ukraine: Scotch pine (*Pinus sylvestris* L.), mountain pine (*Pinus mugo* Turra), Swiss stone pine (*Pinus cembra* L.), Crimean pine (*Pinus pallasiana* D. Don) [8], Stankewicz pine, an endemic race of Calabrian pine (*P. brutia* Ten. *var. stankewiczii* (Fomin) Gaussen) and Kochian pine (*Pinus kochiana* Kloizch.ex K.Koch).

Forests whith Scotch pine grow on vast areas of the Ukrainian Polissya, Small Polissya, Roztochcha and Forest-Stepe regions as well as in the Forest Steppe and Stepe region on sandy soils of coniferous forest terraces along rivers, now and then — in Ukrainian Carpathians. Scotch pine artificial forest is one of basic sources of wood in our country. Conifers that grow in Ukraine, apart from pine, comprise Norway spruce (*Picea abies (*L.) Karst.), European larch (*Larix decidua* Mill.), Polish larch *(Larix polonica* Racib. = L. decidua Mill. subsp. polonica (Racib.) Domin), common silver fir (*Abies alba* Mill.), common juniper (*Juniperus communis* L.), Crimean juniper (*Juniperus excelsa* Bieb.), Siberian Juniper (*Juniperus sibirica* Burgsd), Prickly Juniper (*Juniperus oxycedrus* L.), Foetid Juniper (*Juniperus foetidissima* Willd.) Pygmaea Juniper (*Juniperus pygmaea* C.Koch), creeping juniper (*Juniperus sabina* L.), common yew (*Taxus baccata* L.*).*

In the territory of Ukraine, European larch (*Larix decidua Mill.*) and Polish larch (*Larix polonica Racib.*) of natural origin are conserved as individual biogroups only in the Carpathians at an altitude of up to 1500 m above the sea level [9].

Forests with predominantly deciduous species cover slightly over 2 mln. ha. Broad-leaved species (oak, beech) predominantly cover 43.2% of the total forested area; soft-leaved species (birch, poplar, aspen) largerly occupy 13.6% of the total forested area. Forests with predominant oak trees occupy 1.69 mln.ha. English oak is widespread over the whole plain part of Ukraine (with the

exception of the south Steppe region) and at the foot of the Carpathians. Forests of durmast oak are concentrated in the south-west region of the country and in the Crimea, with individual localities found in the Polissya region. Forests with predominant European beech *(Fagus silvatica)* and oriental beech (*Fagus orientalis*) occupy 0.56 mln.ha. They are located in mountaneous districts of the Carpathians and Crimea as well as in the west part of the Ukraine's plain (the border across the river Smotrich in Khmelnytskyi region) (Annex B).

1.7. Forest types

In the past, forest ecosystems of Ukraine were subject to intensive anthropomorphic disturbances, resulting in primary forests being few in number. In Ukraine, a silvicultural environmental trend in forest typology has become the most advanced. Ukrainian forest typology based on the classification of environmental conditions (moistening and riches of soil) and types of forest vegetation. This typology was developed by Ukrainian scientists Ye.V. Alekseev, P.S. Pogrebnyak, D.V. Vorobyov, B.F. Ostapenko, Z.Yu. Gerushinsky [10, 11, 12, 13, 14, 15, 16]. According to the cadastre of forest types as per the classification adopted in Ukraine, there are the 75 types determined for its plain part (B.F. Ostapenko) [17]. For the Carpathians there are 78 forest types (Z.Yu. Gerushinsky) [18]. For the mountainous Crimea, there are 97 forest types: 79 zonal types, 13 recent types (disturbed for a long time), 3 intrazonal types, 2 relict types (R.R. Posokhov) [19].

Table 3 shows stands of Ukraine that are arranged into groups as per a classification developed by FAO for European countries entitled "European Forest Types – categories and types for sustainable management reporting and policy" (Technical Report (No 9/2006) [20].

Table 3. Major forest type categories and main tree species by "European Forest Types – categories and types for sustainable management reporting and policy" (Technical Report (No 9/2006))

Forest type	Discription	Fores area (Thous. ha)			
		1990	2000	2005	2010
1	2	3	4	5	6
1. Boreal forest	Extensive boreal, species-poor forests, dominated by Picea abies and Pinus sylvestris. Deciduous trees including birches (Betula spp.), aspen (Populus tremula), rowan (Sorbus aucuparia) and willows (Salix spp.) tend to occur as early colonisers.	0,0	0,0	0,0	0,0
2. Hemiboreal and nemoral coniferous and mixed broadleaved-coniferous forest	Latitudinal mixed forests located in between the boreal and nemoral (or temperate) forest zones with similar characteristics to EFT 1, but a slightly higher tree species diversity, including also temperate deciduous trees like Tilia cordata, Fraxinus excelsior, Ulmus glabra and Quercus robur. Includes also: pure and mixed forests in the nemoral forest zone dominated by coniferous species native within the borders of individual FOREST EUROPE member states like Pinus sylvestris, pines of the Pinus nigra group, Pinus pinaster, Picea abies, Abies alba.	2871	3021	3051	3133
3. Alpine forest	High-altitude forest belts of central and southern European mountain ranges, covered by Picea abies, Abies alba, Pinus sylvestris, Pinus nigra, Larix decidua, Pinus cembra and Pinus mugo. Includes also the mountain forest dominated by birch of the boreal region.	567	618	624	641
4. Acidophilous oak and oak-birch forest	Scattered occurrence associated with less fertile soils of the nemoral forest zone; the tree species composition is poor and dominated by acidophilous oaks (Q. robur, Q. petraea) and birch (Betula pendula).	28	30	30	31

continuation on the table 3

1	2	3	4	5	6
5. Mesophytic deciduous forest	Related to medium rich soils of the nemoral forest zone; forest composition is mixed and made up of a relatively large number of broadleaved deciduous trees: Carpinus betulus, Quercus petraea, Quercus robur, Fraxinus, Acer and Tilia cordata.	2166	2361	2384	2448
6. Beech forest	Widely distributed lowland to submountainous beech forest. Beech, Fagus sylvatica and F. orientalis (Balkan) dominate, locally important is Betula pendula.	63	69	70	71
7. Mountainous beech forest	Mixed broadleaved deciduous and coniferous vegetation belt in the main European mountain ranges. Species composition differs from EFT 6, including Picea abies, Abies alba, Betula pendula and mesophytic deciduous tree species. Includes also mountain fir dominated stands.	332	362	365	375
8. Thermophilous deciduous forest	Deciduous and semi-deciduous forests mainly of the Mediterranean region dominated by thermophilous species, mainly of Quercus; Acer, Fraxinus, Carpinus species are frequent as associated secondary trees.	20	22	22	22
9. Broadleaved evergreen forest	Broadleaved evergreen forests of the Mediterranean and Macaronesian regions dominated by sclerophyllous or lauriphyllous trees, mainly Quercus species.	0,0	0,0	0,0	0,0
10. Coniferous forests of the Mediterranean, Anatolian and Macaronesian regions	Varied group of coniferous forests in Mediterranean, Anatolian and Macaronesian regions, from the coast to high mountains. Dry and often poorly-developed soils limit tree growth. Several tree species, including a number of endemics, of Pinus, Abies and Juniperus species.	53	58	59	61
11. Mire and swamp forest	Wetland forests on peaty soils widely distributed in the boreal region. Water and nutrient regimes determine the dominant tree species: Pinus sylvestris, Picea abies or Alnus glutinosa.	123	134	135	138
12. Floodplain forest	Riparian and riverine species-rich forests characterised by different assemblages of species of Alnus, Betula, Populus, Salix, Fraxinus, Ulmus.	492	537	542	557
13. Non-riverine alder, birch or aspen forest	Pioneer forests dominated by Alnus, Betula or Populus.	1031	1233	1245	1279
14. Introduced tree species forest	Forests dominated by introduced tree s above categories. Introduced tree species can be identified at regional (recommended) or national level and comprise: • tree species that are not native to Europe (e.g. Eucalyptus spp., Robinia pseudoacacia, Ailanthus altissima, Prunus serotina, Quercus rubra, Picea sitkensis, Pinus banksiana, Pseudotsuga menziesii, Tsuga heterophylla); • tree species native to Europe, but not naturally occurring within the borders of individual FOREST EUROPE member states; • tree species native only in some regions of an individual FOREST EUROPE country.	355	387	391	402
15. Unclassified forest		520	567	573	588
Total		8621	9399	9491	9746

This classification of forest types comprises 14 groups according to environmental conditions for dominant woody species. Groups 1-10 and group 13 represent the expansion of zonal natural forests containing basic woody species. Groups 11-12 represent out-of-zone forests. Group 14 represents forests containing introduced woody species, specifically plantations. The data were drawn from the FAO report on "State of Europe's Forests, 2011".

In Ukraine, according to Table 3, the most expanded are forest types represented by forests that are hemiboreal and nemoral coniferous and mixed broadleaved-coniferous forest with the predominance of *Pinus sylvstris* and with the involvement of deciduous species as part of stands. This intermediate type covers the area of 3133 thousand ha. The other large group is represented by forest types that predoninantly contain mesophytic deciduous forests with the predominance of English oak and durmast oak and other related deciduous species, occupying the area of 2448 thousand ha. A considerable group is repsented by adler, birch, poplar and aspen forests occupying the area of 1279 thousand ha. Much less space is covered by subalpine forests with the area of 641 thousand ha, flood-plain forests with the area of 557 thousand ha, forests containing introduced woody species with the area of 402 thousand ha, mountain beech forests with the area of 375 thousand ha. Other forest types occupy minor areas, whereas boreal and broad-leaved evergreen forests are entirely absent. Over the last 20 years, a tendence is evident for an increase in the area occupied by all forest types.

The most intensive increase is observed in the area occupied by the above intermediate forest type (hemiboreal and nemoral coniferous) with the predominance of *Pinus sylvestris* (262 thousand ha), by mesophytic deciduous forests with the predominance of English oak and durmast oak (282 thousand ha), and soft-leaved forests with the predominance of alder, birch, aspen and poplar (248 thousand ha).

II. STATE OF FOREST GENETIC RESOURCES OF UKRAINE

2.1. The Current State of Forest Genetic Resources

2.1.1. Study of intraspecific diversity

The intraspecific diversity of forest woody species has been studied in Ukraine over about 200 years. For example, Prof. V.M Chernyaev of Kharkiv National University was the first who drew up a description of Ukraine's forests and singled out phenological forms of English oak [21]. At a later time, with the aim of assessing the intraspcific polymorphism, a number of scientists studied the variability of morphologic features (P.S. Pogrebnyak,1926[22]; O.S. Machinsky, 1927 [23]; V.M. Andreev [24]; G.I. Popalavska,1927 [25]; P.I. Molotkov, 1972 [26]; M.A. Golubets, 1978 [107]; I.M.Shvadchak, 1989 [27]; R.M.Yatsik, 1981 [28]), phenolodical features (V.M Chernyaev, 1858 [21]; S.S. Pyatnitsky, 1954 [29]), morphophisiologic features (G.T. Krinchitsky 1993[30]; V.K. Zayika, 1995 [31]), biochemical features I. Vishni, 1995 [32]; R.T. Volsyanchuk, 1996 [33]; I.I.Korshikov, 2007 [34]; R.T. Gut, 2009 [35]); molecular genetic indices (R.T.Gut, 2004 [36]) in an effort to find optimal approaches to the conservation of biodiversity and to improve the persistence of forest ecosystems.

Over about 100 years, resarches on geographical variability in provenance tests of English oak, Scotch pine and ash has been carried out [37, 38, 39, 40]. Based on results of theese reaesrches, the most resistant climotypes and ecotypes of English oak and Scotch pine have been selected.

Ukrainian Research Institute of Forestry and Forest Melioration, Ukrainian Research Institute of Mountain Forestry, and their research network are studying the cross-species and interspecific diversity of forest woody species in connection with selection researches (Molotkov et al., 1982) [41]. Substantial attention has been given to reproductive biology of species (Berezhnoy, 1979) [42], specifically to *Pinus sylvestris* (Mazhula, 1992; Tereshchenko, 2003) [43, 44], to European and silver spruce (Yatsik, Gaida, 2009, 2011) [45, 46], to European larch (Yatsik, Sishuk, Gaida, 2011) [47], to Douglas Fir (Yatsik et al., 2008) [48] and to English oak (Romshov, 1955; Pyatnitsky, 1954, Los, 2008, 2009, Gavrusevich et al., 2010) [49, 50, 51, 52 53] and to the phenologic variability of English oak (Belous, 1974, 1977) [54, 55].

The subject of study is associated with peculiarities of growth and resistance of larch hybrids under different conditions of Ukaine (Debrinyuk, 2008; Grogoryeva, 2009; Yatsik et al., 2009) [56, 57, 58]. The intraspecific variability ana the shape-related and selectional structure of European larch in culture biocenoses are also under study [59, 60, 61]. In National Natural Park "Svyati hory", researches on peculiarities of growth, development and reproduction of "chalky" pine, its natural renewal are carried out (Zhurova, 2010) [62].

Since the mid-1960s, a Laboratory of selection of Ukrainian Research Institute of Forestry and Forest Melioration have conducted studies on forest tree species at anatomical and cytologic levels after such directions:

- embryological researches of female and male gametophytes of *Populus* L. and *Salix* L. families (M.M.Barna,1969, Z.P. Kots, 1970,1972;) [63, 64, 65]
- study of cytoembryological peculiarities during the forming and developing of female and male gametophytes of *Pinus sylvestris* (Z.P. Kots,1974, 1975) [66, 67]
- cytologic researches of processes of forming of male gametophyte of English oak (O.I.Sverdlova, 2005) [68]
- researches of the variability of karyological characteristics of *Pinus sylvestris* (O.I. Kirichenko, 1983, 1984) [69, 70]
- cytologic researches of apical meristems of conifer and deciduous species (T.L. Kuznetsova, L.O. Torosova, 2008) [71]
- study on the anatomical structure of needles of *Pinus sylvestris* and other conifers and their hybrids (I.M.Patlay,1984, L.I.Tereshchenko, 2002)[72, 73].
- researches of processes of mitosis and meiosis for various woody species (L.O. Deshko, 2001; O.I.Sverdlova, 2005) [74, 68]
- cytologic monitoring over the reproductive sphere of *Pinus sylvestris* in the zone of radioactive contamination (V.V. Mitrochenko, 1999) [75]

National University of Bioresources and Nature Management of Ukraine carries out researches on the variability of Scotch pine [76], poplars and willows (Ya.D. Fuchilo, M.V. Sbytna.) [77, 78] to introduce fast-growing forms in planted forests and stands for the improvement of their productivity and for the conservation of the valuable genepool of these species.

The intraspecific polymorphism is also studied in National Ukrainian University of Forestry Engineering. Individual works are dedicated to native species, i.e. European spruce (Grechanik, Gozhan, 2008) [79], Canadian spruce (Grechanik, Loferduyk, 2009) [80], European larch (Debrinyuk, 2009) [81], English oak (Gbur, 2011, Gus et al., 2006) [82, 83], European beech (*Fagus sylvatica*) (Gus, 2009; Delegan, 2010, 2011; Melnik et al., 2003., Shvadchak, Paule, Vishny, Gemery, 1994; Gus, Grechanik, Lisoviy, 2009) [84, 85, 86, 87, 88, 89], and introduced species, i.e. Douglas fir (Gus, Grechanik, 2011) [90], common walnut (Gus, Grechanik, 2008) [91], Amur cork tree (Yurkiv, 2011) [92], magnolia (Shovgan, 2008) [93]. The geographic variability of Scotch pine was studied by Z.Yu. Gerushinsky, M.M.Gus, S.V.Zhmurko, and N.M. Ferenz [94, 95, 96, 97, 98]. The geographic variability of European beech (*Fagus sylvatica*) was studied by R.M. Grechanik [99, 100].

During the pre-war period, in the Institute of Botany named after M.G. Kholodny of Academy of Sciences of Ukrtaine, Yu.D Kleopov founded a Ukrainian school of phytocoenology of forest vegetation (Ye.M. Lavrenko, Yu.D. Kleopov) [101 102]. Yu.D. Kleopov started and deepened the study into forest vegetation, its flore, groups, geographic and geomorphologic regularities of its origin, expansion, classification, dynamics, maping and protection. This scientist was the first to single out and describe geographic components of the flore of broadleaved forests of East Europe [103, 104]. In the past-war period, the Institute of Botany continued fundamental researches of forest vegetation to make it possible to reveal of biological, environmental peculiarities and the distribution of main forest-forming tree species in Ukrainian forests (V.O.Povarnitsin, V.K. Myakushko, M.AQ. Golubets, F.O. Grin, M.I. Kosets, V.S. Tkachnko) [105, 106, 107, 108, 109 110]. Results of this research were generalized in the mongraphy "Vegetation of Ukraine. Forests" (1971) [111]. Later on, Yu.R. Shelyag-Sosonko, on having a many-sided insight into oak forests of Ukraine, cleared up their origin and outlined steps of their development and determined historic floristic conditions under which these

forests had formed. He determined the role of tree species in forming of plant associations and pioneered the substantiation to the existence of three levels in the evolution of vegetation. He also worked out a system of genetic classification for broadleaved forests [112].

Basic principles of the Ukrainian school of forest typology and peculiarities in forming of forest site conditions in Ukraine were formulated by Ye.V.Alerseev, P.S.Pogrebnyak, D.V.Vorobyov, B.F.Ostapenko, Z.YU.Gerushinsky [10, 11, 12, 13, 14, 15]. The classification of forest sites was suggested by Ye.V.Alekseev and P.S.Pogrebnyak [10, 11]. D.V.Vorobyov and B.F.Ostapenko identified the relationship between climatic indices and forest vegetation. They singled out basic forest-related typological units and worked out fundamentals of zoning the territory of Ukraine in terms of forest typology [12, 13, 14]. A complete cadastre of forest types was prepared [13]. Forests of the north Steppe region have been under study [113]. Types of flood-plain forests were classified in relation to the flooding time (V.P. Tkach) [114].

In recent years, an impetus has been given to the phytosozological research, specifically in the field of dendrodiversity. Among important researches on the protection of diversity of woody plants are the identification of types of forming the cenosis-generating diversity of Ukrainian forests. A phytosozological analysis was carried out into theese types (S.YU. Popovich, P.M.Ustimenko) [115, 116]. The results obtained were summarized in the following monographies: “The Green Book of Ukraine. Forests” (2002) [117], “Synphytosozology of forests of Ukraine” (2002) [118], “The rare phyto-ceno-bank of Ukraine”(2007) [119], “The preserved dendrosozoflore of the Forest-Steppe region of Ukraine” (2010) [120], “The dendrosozological catalogue of the natural reserved bank of the Forest-Steppe region of Ukraine” (2011)[121].

Autochtonous beech forests of the Ukrainian Carpathians were studied by V.I.Parpan and S.M.Stoiko [122], M.V. Chernyavsky [123, 124, 125, 126]; cedar and pine forests by S.M.Stoiko, P.R.Tretyak and I.I.Boychuk [127]; cedar-spruce forests and beech-spruce forests by M.V. Chernyavsky and M.B. Shpilchak [128, 129]; and oak forests by S.M.Stoiko [130].

Dendrofloristry was developed in the context of preparation of the fluoristic reports “The flore of Ukraine” [131] where lists of species of woody plants and their descriptions are given. Each species is presented with its synonyms, detailed morphological descriptions, and, as may be required, with original pictures, data on its expansion and peculiarities in terms of ecological cenosis.

The irreversibility of adverse processes in the vegetable world generated a need for measures on protection and renovation of species and plant associations of this world. For example, the Red Book of Ukraine was published in 1980, with its third edition of 2009 being in effect now [1]. This book describes rare and disappearing plant species that require a special protection to their habitats and steps to be taken for the conservation and reproduction thereof. The first edition of the Red Book of Ukraine comprised 150 species of plants, wheras the present-day edition comprises over 600 such species. Most of endemic and rare species are found in the Crimean mountains and Ukrainian Carpathians.

The botanic gardens are engaged in studying the variability of species that are introduced within their territoty and within dendrological parks [132, 133]. The Ukrainian Research Institute of Forestry and Forest Melioration and Ukrainian Research Institute of Mountain Forestry have been performing researches on introduced woody species with the aim to identify their prospects for forestry and protective reforestation [134, 135, 136].

No certain special initiatives or informational systems exist in relation to the nature of intraspecific genetic variability. Only individual studies in this respect are perfomed by the National Forestry Engineering University of Ukraine [36,137] and Donetsk botanical garden [34, 138, 139] .

Demands of Ukraine for increased potentialities for the assessment and monitoring over the inter-species and intraspecific variability involve the necessity of increased financial support in an effort to acqure equipment and to perform researches on forests and places of genetic conservation, specifically with the use of present-day molecular genetic methods.

2.1.2. Prioity forest tree species

Today in Ukraine, about 50 woody species are used in economy. Table 4 shows woody species that are priority-oriented for Ukraine's economy. Information about currently used tree species is represanted in the table 5.

Table 4. Priority forest tree species (scientific names)

Priority species		Native (N) or exotic (E)	Reasons for priority
Scientific name	Tree (T) or other (O)		
Pinus sylvestris	T	N	economic importance
Pinus nigra ssp. pallasiana	T	N	economic importance
Quercus robur	T	N	economic importance
Quercus petraea	T	N	economic importance
Picea abies	T	N	economic importance
Fagus silvatica	T	N	economic importance
Abies alba	T	N	economic importance
Betula pendula	T	N	economic importance
Alnus glutinosa	T	N	economic importance
Robinia pseudoacacia	T	E	economic importance
Fraxinus excelsior	T	N	economic importance
Cerasus avium	T	N	economic importance
Ulmus sp.	T	N	economic importance
Larix decidua	T	N/E	economic importance
Larix leptolepis.	T	E	economic importance
Juglans nigra	T	E	economic importance
Pseudotsuga menziesii	T	E	economic importance
Acer pseudoplatanus	T	E	economic importance
Acer plananoides	T	E	economic importance
Tilia cordata	T	E	economic importance

2.1.3. Protected forest tree species

In 1994 Ukraine ratified the Convention on Biodiversity. Currently, the reservation protection of forests on the territory of Ukraine is 5.4 % (3 268 000 ha).

In accordance with Order No.312 dated 17.06.2009 issued by Ministry of Ecology and Natural Resources of Ukraine "On aproval of lists of species of plants and mushrooms that are included into the Red Book of Ukraine", 826 species of plants and mushrooms are registered in the Red Book of Ukraine, including 50 species of trees and bushes (Annex C) [1]. Among them there are 11 species that are on the European Red List and 5 species that are on the IUCN List. Among forest trees there are 16 protected species, namely:

1. ***Juniperus excelsa*** M.Bieb. – a relict Mediterranean species on the southern border of the area that is included in The Red Book of Ukraine. Sites of *Junipereta excelsae* formation are included in The Green Book of Ukraine and protected in the Yalta mountain-forest reserve "Mys Martyan", the Karadag natural reserve , and in the forest reserve of national importance "Ayu-Dag", "Karaul-Oba", "Novy Svit", "Kanaka" and others.
2. ***Juniperus foetidissima*** Willd. – a Mediterranean species on the southern border of the area that is included in The Red Book of Ukraine. Sites of *Junipereta foetidissimae* formation are included in The Green Book of Ukraine and protected in the Crimean natural reserve.
3. ***Larix polonica*** Racib. (*L. decidua* Mill. subsp. *polonica* (Racib.) Domin) – an endemic species of disjunctive area that is included in The Red Book of Ukraine and the IUCN Red List. (IUCN RL). This forest groups with its co-dominance are included in The Green Book of Ukraine and protected in the territory of the botanical reserve of national importance "Kedrin" and the forest

reserve of national importance “Urochishche Skit Manyavsky”.

4. ***Pinus cembra*** L. – a Mediterranean mountain pleistocene relict that is included in The Red Book of Ukraine. Sites of *Pineta cembrae* formation are included in The Green Book of Ukraine” and protected in the natural reserve “Gorgany”, in the Carpathian national natural park, in botanic reserve of national importance “Kedrinsky”, “Tavpishirsky”, “Yaikivsky”, in landscape forest reserve of national importance “Bredulets”, “Grofa”.

Table 5. Forest species currently used in Ukraine

Scientific name	Native (N) or exotic (E)	Current use (code)*	If managed, type of forest management (i.e. natural and artificial forests, agroforestry)
Pinus sylvestris	N	1,3,4,5,6	natural and artificial forests, agroforestry
Pinus pallasiana (Pinus nigra ssp. pallasiana)	N	1,4,5	natural and artificial forests, agroforestry
Quercus robur	N	1,3,4,5	natural and artificial forests, agroforestry
Quercus petraea	N	1,3,4,5	natural and artificial forests, agroforestry
Quercus rubra	E	1,3,4,5	artificial forests, agroforestry
Picea abies	N	1,2,34	natural and artificial forests
Fagus sylvatica	N	1,3,4	natural and artificial forests
Abies alba	N	1, 3,4	natural and artificial forests
Betula pendula	N	1, 3, 4, 5, 6	natural and artificial forests
Alnus glutinosa	N	1, 3,4	natural and artificial forests
Alnus incana	N	1, 3,4	natural forests
Robinia pseudoacacia	E	1, 3,4, 5	artificial forests, agroforestry
Fraxinus excelsior	N	1, 3,4, 5	natural and artificial forests, agroforestry
Cerasus avium	N	1,4,5	natural and artificial forests, agroforestry
Carpinus betulus	N	1,3,5	natural and artificial forests, agroforestry
Ulmus sp.	N	1,4,5	natural and artificial forests, agroforestry
Populus sp.	N/E	2,3, 5	natural and artificial forests, agroforestry, forest plentations
Larix decidua	N/E	1,5,6	natural and artificial forests, forest plantations
Larix leptolepis.	E	1,5,6	artificial forests, forest plantations
Juglans nigra	E		artificial forests, forest plantations
Pseudotsuga menziesii	E		artificial forests, forest plantations
Gleditsia triacanthos	E	5	agroforestry
Acer platanoides	N	1, 3, 4,	natural and artificial forests
Acer pseudoplatanus	N	1, 3, 4, 5,	natural forests
Tilia cordata	N	1, 3, 4, 5,	natural and artificial forests
Salix alba	N	3,4	agroforestry

Current use:

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

5. ***Pinus cretacea*** (Kalenicz.) Kondr. (*Pinus sylvestris* L. var. *cretacea* Kalenicz. ex Kom.)

– a disjunctive relict that is included in The Red Book of Ukraine and the IUCN Red list. (IUCN RL) and protected in the national natural park “Svyati Hory” and in the Ukrainian steppe natural reserve (its branch “Kreydova flora”).

6. ***Pinus stankewiczii*** (Sukacz.) Fomin (*P. brutia* Ten. var. *pityusa* (Steven) Silba p.p., P. brutia subsp. stankewiczii (Sukacz.) Nahal, P. *pityusa* Steven var. *stankewiczii* Sukacz.) – an endemic race (var. *stankewiczii* Sukacz.) of thermophilic Mediterranean species *P. brutia* that is found on the southern border of the area and is included in The Red Book of Ukraine and the IUCN Red list. (IUCN RL). Sites of *Pineta pithyusae* formation are included in The Green Book of Ukraine. This species is protected in the landscape reserve of national impoprtance “Mys Aya” and in the botanic reserve of national importance “Novy Svit”, and in the integrated natural monument “Girsky massif Karaul-Oba”.

7. ***Taxus baccata*** L. – an uncommon relict species of disjunctive area that is included in The Red Book of Ukraine. Forest associations with its co-dominance in subordinate layers are included in The Green Book of Ukraine and protected in the Carpathian biospheric reserve, in the Crimean and Yalta mountain-forest natural reserves, in the national natural parks “Karpatsky” and “Sklivski Beksydy”, in the landscape reserve of national importance “Velyki kanyon Krymu”, and in the botanic natural monument of national importance ”Tysovy Yar”.

8. ***Pistacia mutica*** Fisch. et C.A.Mey. (*P. atlantica* Desf. subsp. *mutica* (Fisch. et C.A.Mey.) Rech.f.) – a Mediterranean relict species on the northern border of the area that is included in The Red Book of Ukraine. Sites of *Pistacieta muticae* formation are included in The Green Book of Ukraine and protected in the Yalta mountain-forest reserve “Mys Martyan” and in the Karadag natural reserve, in the landscape reserve of national importance “Ayu-Dag”, “Mys Aya”, “Baydarsky”, “Mys Fiolent”, in the botanic reserve of national importance “Novy svit”, “Kanaka”, and in the integrated natural monument “Hora Kishka”.

9. ***Betula borysthenica*** Klokov – a BlackSea-transVolga neoendemic species that grow in sandy valleys, included in The Red Book of Ukraine. Sites of *Betuleta borysthenicae* formation are included in “The Geen Book of Ukraine” and protected in the Black-Sea biospheric reserve, in the regional landscape park “Kinburynska kosa”, in the forest reserve of national importance “Berezovi kolky”.

10. ***Betula klokovii*** Zaverucha – a niche endemic that is included in The Red Book of Ukraine and protected in the natural reserve “Medobory”.

11. ***Betula obscura*** A.Kotula (incl. *B. kotulae* Zaverucha; *B. pendula* Roth subsp. *obscura* (A.Kotula) Á.Löve, *B. verrucosa* Ehrh. subsp. *obscura* (A.Kotula) Á.Löve et D.Löve) – a central European species with an unidentified taxonomic status that is included in The Red Book of Ukraine and protected in the natural reserves “Roztochchya”, “Medobory”, “Gorgany”, and the natural monument “Bukovynka”.

12. ***Arbutus andrachne*** L. – a Mediterranean relict species on the northern border of the area. This is the only ever-green species in Ukraine that is included in The Red Book of Ukraine. Sites of *Arbuteta andrachnis* formation are included in The Green Book of Ukraine and protected in the the Yalta mountain-forest reserve “Mys Martyan” and in the landscape reserve of national importance “Mys Aya” and “Ayudag”.

13. ***Quercus cerris*** L. (*Q. austriaca* Willd.) – an east-Mediterranean north-European disjunctivly widespread species on the north-east border of the area that is included in The Red Book of Ukraine. The forest associations with its co-dominance are enterted in The Green Book of Ukraine and protected in the Carpathian biospheric reserve, in the botanic natural monument “Velykyi lis”, and in the regional landscape park “Prytysyanskiy”.

14. ***Fraxinus ornus*** L. – a relict sub-Mediterranean species on the northern border of the area in an isolated locality that is included in The Red Book of Ukraine. The forest associations with its co-dominance are enterted in The Green Book of Ukraine and protected in the Carpathian biospheric reserve and in the regional landscape park “Prytysyanskiy”.

15. ***Tilia dasystyla*** Steven – a relict species with a disjunctive area that is included in The Red Book of Ukraine and the European Red List (ERL). It is protected in the Crimean mountain forest

reserve, Yalta mountain forest reserve, Karadag mountain forest reserve, the reserve of national importance “Kubalach”, and the natural monument of local importance “Hora Kastel”.

16. ***Sorbus torminalis*** (L.) Crantz (*Crataegus torminalis* L., *Pyrus torminalis* (L.) Ehrh.) – a disappearing species that is included in The Red Book of Ukraine and protected in the territory of in the Crimean mountain forest reserve, Yalta mountain forest reserve, Karadag mountain forest reserve, in the natural reserve “Medobory”, the national natural parks “Podilski Tovtry”, “Karmelyukove Podillya”. “Zacharovany Kray”, the regional landscape parks “Chernivetskiy”, and in reserved plots of land and natural monuments.

Below there is a list of woody plants that are protected only at a regional level and would require a nature protection status at the national level:

1. ***Tilia argentea*** Desf ex DC — is situated on the north-east border of the area in insular localities of the Volcanic foothills in the Transcarpathian region. Sites of *Tilieta argenteae* formation are included in The Green Book of Ukraine and protected in the Carpathian biospheric reserve and the reserved plot of land “Hora Bihanska”.

2. ***Quercus dalechampii*** Ten. – is an Illyrian south-European species on the northern border of the area in insular localities of Volcanic foothills in the Transcarpathian region. The forest sites with its co-dominance are included in The Green Book of Ukraine and protected in the Carpathian biospheric reserve.

3. ***Quercus polycarpa*** Schur. – is a Pontic component part of flore on the northern border of the area in the Transcarpathian region. It is protected in the Carpathian biospheric reserve.

4. ***Fraxinus syriaca –*** is a species of limited occurrence on the northern border of the area in the mountainous Crimea.

In the territory of Ukraine, the following 12 endemic species of trees and bushes grow in a natural way:

Betula borysthenica Klokov – a Black Sea-transVolga neondemic that grow in sandy valleys.

Betula klokovii Zaverucha – a niche endemic species akin to *Betula pubescens* Ehrh.

Cerasus klokovii Sobko (C. fruticosa auct. Non (Pall.) Woronow,

Prunus fruticosa auct. non Pall.) – a niche endemic close to *C. fruticosa.*

Chamaecytisus blockianus (Pawł.) Klásk. (*Cytisus blockianus* Pawł.) – an endemic species.

*Chamaecytisus paczoski*i (V. Krecz.) Klásk. (*Cytisus paczoskii* V. Krecz) - an endemic species.

Crataegus pojarkovae Kossych – a native endemic species.

Daphne sophia Kalen. - a niche endemic species.

Daphne taurica Kotov – a rare endemic species.

Larix polonica Racib. (L. *decidua* Mill. subsp. *polonica* (Racib.) Domin) – an endemic species with a disjunctive area.

*Pinus stankewiczi*i (Sukacz.) Fomin (P. *brutia* Ten. *var. pityusa* (Steven) Silba p.p., P. *Brutia* subsp. *stankewiczii* (Sukacz.) Nahal, P. *pityusa* Steven var. *stankewiczii* Sukacz.) – an endemic race (var. *stankewiczii* Sukacz.) of thermophilic Mediterranean species P. *brutia* that is found on the northern border of the area.

Rosa czackiana Besser - an endemic species of the multiple polymorphous complex *Rosa gallica* L.

2.1.4. System of documentation for forest reproductive material

The system of documentation for forest reproductive material provides for the control over the origin of seeds and their quality. Such a control is carried out by the State Forest Seed Inspection. The Central State Forest Seed inspection is located in the Kyev region (the city of Boyarka). At a regional level, the responsibility for this work is carried out by 7 regional State forest-seed inspections. Information on the origin of seeds is entered in registers and cards. The regional forest-seed inspections are subordinated to the Central State Forest-Seed Inspection and the State Forest Resources Agency of Ukraine.

Annually, seeds collected from over 130 species of trees and bushes are prepared, including decorative species. In 2011, for example, 1006 thousand kg of seeds were stored up from 133 species (255 thousand kg of seeds were collected from seed orchards). Amongst these, about 50 species were basic forest-forming species (see Table 6).

About 40 thousand ha of artificial forests involving over 20 species of trees are created in Ukraine every year. In doing so, over 190 mln. seedlings are used. So, 373 961 thousand seedlings were planted in 2011 (see Table 7). A portion of stands is created by sowing seeds, with over 150 thousand kg of seeds being used. In 2011, the area of 25.7 thousand ha was reforestated, the area of 22.34 thousand ha was afforestated. 13.4 tousand ha of forests were regenerated in a natural way.

Table 6. Annual quantity of seeds produced and current state of identification of forest reproductive material of the main forest tree species and other woody species in Ukraine in 2011

№	Species		Total quantity of seeds used (Kg)	Quantity that is genetically improved (from seed stands and seed orchards) (Kg)
	Scientific name	Native (N) or Exotic (E)		
1	2	3	4	5
1	*Betula pendula* Roth (*B. verrucosa* Ehrh.)	E	768	
2	*Sorbus torminalis* (L.) Crantz	N	22	
3	*Fagus sylvatica* L.	N	291	25
4	*Alnus glutinosa* (L.) P.Gaertn.	N	193	
5	*Ulmus glabra* Huds.	N	14	
6	*Ulmus parvifolia* Jacq.	E	379	
7	*Aesculus hippocastanum* L.	E	12914	
8	*Gleditsia triacanthos* L.	E	11721	
9	*Juglans regia* L.	E	12523	4580
10	*Juglans mandshurica* Maxim.	E	361	12
11	*Juglans cinerea* L.	E	226	1900
12	*Juglans nigra* L.	E	40256	
13	*Sorbus aucuparia* L.	N	126	
14	*Carpinus betulus* L.	N	125	
15	*Pyrus communis* L.	N	303	
16	*Cornus mas* L.	N	332	
17	*Quercus robur* L.	N	684011	217716
18	*Quercus rubra* L.	E	154824	25655
19	*Quercus pubescens* Willd.	N	100	
20	*Quercus petraea* Liebl.	N	1530	260
21	*Castanea sativa* Mill.	E	538	20
22	*Acer platanoides* L	N	3673	6
23	*Acer pseudoplatanus* L.	N	5109	500
24	*Acer saccharinum* L.	E	275	
25	*Acer tataricum* L	N	541	
26	*Acer negundo* L.	E	356	
27	*Tilia platyphyllos* Scop.	N	1992	
28	*Tilia cordata* Mill	N	1942	150
29	*Amygdalus communis* L.	E	1072	
30	*Larix decidua* Mill.	N	237	152
31	*Robinia pseudoacacia* L.	E	12465	271
32	*Prunus domestica* L.	N	70	
33	*Prunus spinosa* L.	N	132	
34	*Prunus divaricata* Ledeb.	E	1653	

continuation on the table 6

1	*2*	3	4	5
35	*Pinus sylvestris* L.	N	12444	1473
36	*Pinus pallasiana* D. Don *(Pinus nigra ssp. pallasiana)*	N	2572	345
37	*Pinus stankewiczii* (Sukaczev) Fomin	N	29	17
38	*Sophora japonica* L.	E	647	
39	*Chaenomeles japonica* (Thunb.) Lindl.	E	76	
40	*Padus avium* Mill. (*P. racemosa* (Lam.) Gilib.)	N	438	
41	*Padus serotina* (Ehrh.) Ag.	E	864	
42	*Cerasus avium* (L.) Moench	N	1775	
43	*Malus sylvestris* Mill.	N	201	
44	*Picea abies* (L.) H.Karst.	N	802	70
45	*Abies alba* Mill.	N	5813	2480
46	*Juniperus virginiana* L.	E	25	17
47	*Fraxinus ornus* L.	N	22	
48	*Fraxinus excelsior* L.	N	2582	39
49	*Fraxinus lanceolata* Borkh	E	3998	
50	Other species		23132	3
TOTAL			**1 006 499**	**255 248**

Table 7. Annual number of seedlings planted (2011).

№	**Species**		**Total quantity of seedlings planted**	**Quantity of seedlings from documented sources (provenance / delimited seed zones)**	**Quantity of vegetative reproductive material used**	**Quantity of seedlings that are genetically improved**
	Scientific name	**Native (N) or Exotic (E)**				
1	**2**	**3**	**4**	**5**	**6**	**7**
1	*Aronia melanocarpa* (Michx.) Elliott	E	234		1	
2	*Betula pendula* Roth (*B. verrucosa* Ehrh.)	E	925		1	
3	*Ligustrum vulgare* L.	N	991		6	
4	*Sambucus racemosa* L.	N	237			
5	*Sambucus nigra* L.	N	842			
6	*Fagus sylvatica* L.	N	1643	141,2		
7	*Alnus glutinosa* (L.) P.Gaertn.	N	729		1	
8	*Ulmus glabra* Huds.	N	30,6			
9	*Ulmus parvifolia* Jacq.	E	827,6			
10	*Ulmus pumila* L.	E	21,8			
11	*Gleditsia triacanthos* L.	E	6040			
12	*Juglans ailanthifolia* Carriere (*J. sieboldiana* Maxim.)	E	0,8			
13	*Juglans regia* L.	E	200,9	73,5		
14	*Juglans mandshurica* Maxim.	E	5,8	0,2		
15	*Juglans cinerea* L.	E	3,6			
16	*Juglans nigra* L.	E	645,9	30,4		
17	*Sorbus aucuparia* L.	N	222			
18	*Carpinus betulus* L.	N	18			
19	*Pyrus communis* L.	N	733			

continuation on the table 7

1	2	3	4	5	6	7
20	*Quercus robur* L.	N	67178	20282,3		68,8
21	*Quercus rubra* L.	E	13901	2303,5		
22	*Lonicera tatarica* L.	N	367		1	
23	*Viburnum opulus* L.	N	191		1	
24	*Acer platanoides* L	N	2892,5	4,7		
25	*Acer pseudoplatanus* L.	N	4023,4	39,4		
26	*Acer campestre* L.	N	3,2			
27	*Acer saccharinum* L.	E	216,5			
28	*Acer tataricum* L	N	426	2,4		
29	*Acer negundo* L.	E	280,4			
30	*Tilia platyphyllos* Scop.	N	642	48,3		
31	*Tilia cordata* Mill	N	626			
32	*Corylus avellana* L.	N	99			
33	*Larix decidua* Mill.	N	1385	163,6		724,6
34	*Hippophaë rhamnoides* L.	N	14			
35	*Robinia pseudoacacia* L.	E	19814	430,8		
36	*Swida sanguinea* (L.) Opiz	N	1165			
37	*Ribes aureum* Pursh	E	23,8		1	
38	*Ribes nigrum* L.	N	76,2		1	
39	*Pinus sylvestris* L.	N	189592	6825,6	5	14092,9
40	*Pinus pallasiana* D. Don *(Pinus nigra ssp. pallasiana)*	N	24168	2772		53,9
41	*Thuja occidentalis* L.	E	621		441	
42	*Rosa rugosa* Thunb.	E	9,6			
43	*Rosa canina* L.	N	2223,4	1,6		
44	*Morus alba* L.	E	57,4			
45	*Morus nigra* L.	E	130,6			
46	*Malus sylvestris* Mill.	N	903			
47	*Picea abies* (L.) H.Karst.	N	17265	1506,9	33	
48	*Abies alba* Mill.	N	3289	1350		22,3
49	*Juniperus virginiana* L.	E	222	151	206	
50	*Fraxinus excelsior* L.	N	7805	117,9		
TOTAL			**373 961**	**36 245**	**698**	**14 963**

2.1.5. Activities aimed at conserving the genetic diversity

Methods of forest management that have been used over the last years contribute to a certain extent to the conservation of the genepool of forest tree species. On the other hand, the complexity of natural afforestation, resulting at times from the prevailing clear-cutting system of forest management and at other times from severe environmental conditions, makes the creation of the genepool more difficult and requires additional funding.

When making a forest inventory, mensurational descriptions of stands in most cases contain a conservation status of each forest plot (a seed orchard, a plus stand, a genetic reserve, a protected area of local significance, etc.). Besides, a mensurational description contains information on the presence of plus trees. At regular intervals, a State forest-seed inspection makes an inventory of the status of seed-growing objects which at once are units of genetic conservation.

The first steps towards the conservation of the genetic diversity of forest woody species in Ukraine were taken in the framework of creating of provenance test plantations for basic forest-forming species (almost 100 years ago) and during the progress of work on selection of forest species over 50 years ago (plus trees and plus stands were selected). In early 1980s, a large-scale and task-

oriented work on genetic conservation started in Ukraine, based on methodological approaches that were specified in the regulatory document "Regulation on the allocation and conservation of the genepool of woody species in forests of the USSR" (1982) [140]. The majority of units and areas of genetic conservation that are now included in the valid State Register were choosen at that time. In Ukraine, altogether 478 genetic reserves of 30 species with the total area of 24.05 thousand ha were allocated at that time [141].

Over the years of 2000-2005, staff members of the Ukrainian Research Institute of Forestry and Forest Melioration, Ukrainian Research Institute of Mountain Silviculture and of related research stations carried out an inventory of units of genetic conservation for deciduous species in the framework of the international project "Genetic Resources of Broadleaved Species in Southeastern Europe" with the assistance of forest enterprises subordinated to the State Agency of Forest Resources of Ukraine. A similar work on coniferous species was performed in the Carpathian region of Ukraine and in adjacent areas. Methods for the comprehensive assessment of genetic reserves of forest tree species were developed [142, 143, 144]. In the western region of Ukraine, the use of a a multiple-factor index of functionality was suggested and approved to assess genetic reserves [145]. It was found out that 5 to 15 % of different genetic reserves do not fit for criteria set for units of genetic conservation related to the valuable genepool [145, 146]. A tendency to degradation of condition of genetic conservation units was observed. At the same time there is evidence that forest enterprises are increasing their activities towards depriving these units of their protective status. On the other hand, the forest-seed inspection and scientific institutions do not support the reduction of units of genetic conservation in area. The selection of new units of genetic conservation *in situ* is often problematical due to considerable reduction of area of natural forests.

In 2011 in Ukraine, there was adopted "A concept of the conservation and sustainable use of forest genetic resources in Ukraine" [147]. This is a document that sets strategic goals and tasks as well as procedural, methodical and organizational principles and techniques of activity aimed at conserving the genetic variability of forest arboriflore. The consept serves as a basis to develop new regulatory legal acts and improve the existing regulatory legal acts that regulate various aspects of the conservation of biodiversity in forests.

A strategy and technology on the genetic conservation of forest woody species has no become an important tool for implementing basic provisions of the concept of the conservation and sustainable use of the genetic variability of forest woody species in Ukraine. At the present time, the valid legal regulatory documents in Ukraine slightly differentiate approaches to conserving the genetic variability of separate species. The principle of differentiating the strategies of genetic conservation is partly implemented in "Recommendations on the conservation, rehabilitation and use of genetic resources of valuable forest woody species of limited occurrence in the Carpathian region and its adjacent territories" (2005 p.)[148].

At the moment, a work is nearing completion on the refinement and co-ordination of the document entitled "Regulations on the allocation, conservation and sustainable use of the genepool of forest woody species in Ukraine" [149] which regulate differentiated approachers to the conservation of forest genetic resources of basic forest-forming species and less-common autochtonous and introduced tree species.

The following are basic criteria for selecting especially valuable forest lands in Ukraine: a degree of naturality of a forest land and of its diversity; a level of diversity abundance; a level of significance of diversity (European, national, regional, local); uncommonness of diversity; availability of endemic, relict and rare species; representativeness and typicality of diversity; completeness of diversity; the optimality of size and the naturality of borders; a degree of functional significance of diversity; the compliance with a full landscape structure. For the basic level in identifying of an environmental value of forest lands a local level is taken, i.e. forest stands that form small and indivisible forest ecosystems at a landscape level. For an elementary unit of study a forest taxation unit is taken. Such an approach is a prerequisite both to typological generalizations (according to typological classificatory units) and to spatial generalizations at regional, zonal and national level [150].

2.1.6. The level of public awareness on the importance of forest genetic resources

In Ukraine the level of public awareness on the importance of forest genetic resources in the country is inadequate. Therefore, a pressing problem for Ukraine today lies in ensuring an appropriate informational propagandistic support to measures on the conservation, using and reproduction of the genepool of forests. Steps in this direction have to provide for a full coverage of the subject in the press, on radio and TV, the preparation of monographs, booklets, articles, and the dissimination thereof among forest owners and permanent users of forests as well as the population. The content, forms and methods of the process related to the conservation of genetic resources have become mandatory componenets of academic programs on training specialists of biological, ecological, and forestry-based profiles. For these programs to be realized, it is necessary to introduce a systematic approach to the study into genetic diversity, methods of its protection, conservation, rational use, and reproduction on principles of present-day postulates of forest genetics, population ecology, and protection of nature.

The need exists for systematic research on the status of units of gnetic conservation at regular intervals of 10 years with the use of a complex of present-day methods of molecular genetics, physiology, biochemistry and biophysycs.

For the purposes of conserving and reproducing the genepool it is necessary to develop and introduce special strategies for certain species or their groups (basic forest-forming and less-common species) in compliance with present-day exploratory studies performed in European countries. To introduce such strategies, it is also necessary to to allocate respective funds.

2.2. The State of *in situ* Genetic Conservation

2.2.1. Target species included and actively managed within *in situ* conservation programmes

50 species of trees and bushes are enterted in the Red Book of Ukraine, among them there are 16 forest tree species (see Item 2.1.3 and Annex C). Most of them have no economic significance, but they are valuable in terms of amelioration, protection, ecology and are integral parts of forest cenosis. They are conserved in the territory of natural reserved units: natural and biosfere reserves, national natural parks, botanical gardens, protected areas, arboretums, natural landmarks, etc.(see Table 8). These protected areas are subordinated to a State Service for Reserve Management and Studies attached to the Ministry of Ecology and Natural Resources of Ukraine, to the State Agency for Forest Resources of Ukraine and some other State bodies. These species are studied by institutions of environmental and botanical profiles of the Academy of Sciences of Ukraine and by botanic gardens.

Table 8. Structure of quantity and areas of natural protected fund (NPF) of Ukraine (as of 01.01.2010, the data of the State Service of Reserves)

Category	Number		Area	
	objects	% from total number	ha	% from total area
Reserves:				
natural (IUCN – Ia)	**19**	**0,2**	**198,7**	**5,7**
biosphere (IUCN – II)	**4**	**0,1**	**246,4**	**7,1**
National natural parks (IUCN – II)	**38**	**0,5**	**1001,8**	**28,7**
The protected area:	**2853**	**37,5**	**1257,5**	**36,1**
national importance (IUCN – IV)	306	4,0	419,7	12,1
Local (IUCN – IV)	2547	33,5	837,8	24,0
Monuments of nature:	**3203**	**42,1**	**26,5**	**0,8**
national importance (IUCN – III)	132	1,7	5,8	0,2
Local (IUCN – III)	3071	40,4	20,7	0,6

continuation on the table 8

1	2	3	4	5
Botanical gardens:	**27**	**0,4**	**1,9**	**0,05**
national importance	18	0,2	1,8	0,05
local	9	0,2	0,1	+
Zoological parks:	**12**	**0,2**	**0,4**	**0,01**
national importance	7	0,1	0,1	+
local	5	0,1	0,3	0,01
Arboretums:	**54**	**0,7**	**1,7**	**0,04**
national importance	19	0,2	1,4	0,03
local	35	0,5	0,3	0,01
Parks, monuments of landscape architecture:	**542**	**7,1**	**13,4**	**0,4**
national importance	88	1,1	6,0	0,2
local	454	6	7,4	0,2
The regional landscape parks: (IUCN – II)	**55**	**0,7**	**639,5**	**18,3**
natural landmarks (IUCN – Ib)	**800**	**10,5**	**97**	**2,8**
TOTAL,	**7607**	**100,0**	**3484,8**	**100,00**
including:				
national importance	631	8,3	1881,7	
local	6976	91,7	1603,1	
Conservation Area (Black Sea)	1		402,5	

The *in situ* conservation of well expanded economically significant forest species, whose natural populations decrease in number and size, is now under the control of the State Agency for Forest Resources. Research on these species is carried out by the Ukrainian Research Institute of Forestry and Forest Melioration, Ukrainian Research Institute of Mountain Silviculture and forest-ortiented universities.

2.2.2. The programs on the *in situ* conservation

The first program on the *in situ* conservatiion of forest genetic resources in Ukraine was developed in 1983 by the selection laboratory of the Ukrainian Research Institute of Forestry and Forest Melioration under the direction of P.I.Molotkov. The program included:

- inventory of natural forests;
- selection of genetic reserves;
- registration of certificates for genetic reserves.

The State Register today (to 01/01/02012) comprises 611 plots of genetic reserves of over 30 forest species with the total area of 23889,7 ha.

In the framework of the international project on "Genetic resources of forest broad-leaved deciduous species of tress in South-East Europe" (cordinated by R.Volosyanchuk) that was implememnted over the period of 2000 to 2005, an inventory was taken for units of genetic conservation of deciduous woody species. Table 9 presents real time data on the availability of genetic reserves by species.

At the same time, the Ukrainian Research Institute of Mountain Silviculture carried out programs on the conservation of forest genetic resources in the Carpathians (coordinated by R.Yatsik). The selection & seed-growing laboratory of this institute worked out the following documents:"Guidelines on the allocation of forest genepool, on the selection and seed-growing in the Ukrainian Carpathians" [151], "Recommendations on the improvement of seed-growing for basic.

Table 9. Target forest species included within *in situ* conservation.
(Gene reserves - units, selected for genepool conservation)

Species (scientific name)	Number of populations or stands conserved	Total Area
1	2	3
Pinus sylvestris	115	5420,1
Pinus sylvestris (relict, Carpathians)	9	545
Pinus cretacea (Pinus sylvestris var. *cretacea)*	2	7,2
Pinus pallasiana (Pinus nigra ssp. pallasiana)	7	133,8
Pinus nigra (Pinus nigra ssp. Nigra)	1	1,5
Pinus stankewiczii	2	42,1
Pinus strobus	1	1,6
Pinus cembra	5	632,1
Pinus mugo	1	1,5
Picea abies	47	2178,9
Abies alba	27	1273,3
Taxus baccata	3	97,1
Pseudotsuga Menziesii	3	23,7
Juniperus excelsa	2	208,6
Larix decidua	4	39
Total Coniferous	**229**	**10605,5**
Quercus robur	249	7758,5
Quercus petraea	16	220,4
Quercus pubescens	1	129
Quercus rubra	3	48,8
Fagus sylvatica	62	4286,8
Fagus taurica	7	140,8
Fraxinus excelsior	5	203,7
Betula pendula	3	36,4
Carpinus betulus	5	53,8
Acer pseudoplatanus	1	7
Pistacia mutica	1	5
Arbutus andrachne	1	196
Sorbus torminalis	1	6,1
Alnus glutinosa	25	179,4
Robinia pseudoacacia	1	10
Ulmus glabra	1	2,5
Total Broadleaves	**382**	**13284,2**
Total	**611**	**23889,7**

native and introduced species on the basis of methods used for the plus- and population-selective breeding in the Carpathian region"[152], "Recommendations on the conservation, reproduction and using of genetic resources of valuable less-common forest woody species in the Carpathian region and

its adjacent territories" [148], "A concept of the conservation and sustainable use of forest genetic resources in Ukraine" [147], "Regulations on the allocation, conservation and sustainable using of the genepool of forest woody species in Ukraine" [149]. All these documents are now in the process of approval

All the above mentioned strudies are conducted in the following areas:

• the research on the structure of populations and their morphologic variability;

• the development of measures on the conservation of forest genetic resources.

In 1950-1960s, an inventory of forests was carried out and the mass of plus stands was selected for breeding purposes. At that time, there were selected over 3 thousand ha of plus stands of 9 forest species. At a later time, a certain portion of these stands lost their status and were replaced with newly selected plots. The State Register for Plus Stands of Ukraine today comprises 141 plots of 11 species that occupy the area of over 2 thousand ha. Over the period of 2010 to 2011, there were selected 78.1 ha of new plus stands of 5 forest species (see Table 10).

Table 10. Plus stands – units selected for genepool conservation and tree improvement

Species (scientific name)	Number of populations or stands conserved	Area, ha	
		total	Selected in 2010-2011
Pinus sylvestris	42	536,1	46,3
Pinus pallasiana (Pinus nigra ssp. pallasiana)	1	7,3	
Pinus nigra (*Pinus nigra ssp. nigra)*	1	4,5	
Picea abies	4	25,9	4,7
Abies alba	4	16,7	
Pseudotsuga Menziesii	1	1,2	
Larix decidua	2	10,0	7,5
Quercus robur	77	1364,9	14,1
Quercus rubra	1	11	
Fagus sylvatica	7	83,2	
Fraxinus angustifolia	1	5,5	5,5
Total	**141**	**2093,3**	**78,1**

The mass selection of plus trees in Ukraine was started under the leadership of S.S.Pyatnitskyi in 1960s [153, 154, 155]. Later on, a portion of these trees was excluded from the State Register due to reviweed criteria and due to the degradation of trees. At the present time, a new stage starts in selecting plus trees. According to a "Program on the development of the forest seed-growing management for the years of 2010 to 2015" [156], it is planned to select additionally 1260 plus trees of 9 species. Over the years of 2010-2011, 688 trees of 6 economically significant species were selected (see Table 11).

Table 11. Plus trees

Scientific name	Native (N) or Exotic (E)	Number of tree.		
		total	selected in 2010	selected in 2011
1	2	3	4	5
Pinus sylvestris	N	1165	135	127
Pinus pallasiana (Pinus nigra ssp. pallasiana)	N	179	0	0

Continuation of the table 11

1	2	3	4	5
Pinus nigra (Pinus nigra ssp. nigra)	N	42	0	0
Pinus cembra	N	19	0	0
Pinus sylvestris ssp. cretacea	N	10	0	0
Pinus stankewiczii	N	20	0	0
Pinus strobus	E	32	0	0
Cedrus libani	E	4	0	0
Cedrus atlantica	E	11	0	0
Cedrus deodara	E	2	0	0
Picea abies	N	210	31	58
Larix kaempferi	E	30	0	0
Larix decidua	N/E	280	30	12
Abies alba	N	233	31	36
Pseudotsuga Menziesii	E	68	2	4
Juniperus excelsa	N	28	0	0
Populus nigra	N	6	0	0
Quercus robur	N	1185	99	105
Quercus petraea	N	163	0	0
Quercus rubra	E	15	0	0
Quercus pubescens	N	12	0	0
Fagus sylvatica	N	189	0	2
Fagus taurica	N	44	0	0
Acer platanoides	N	1	0	0
Acer pseudoplatanus	N	3	0	0
Ceracus avium	N	1	0	0
Fraxinus excelsior	N	37	0	13
Fraxinus lanceolata	E	5	0	3
Total		**3994**	**328**	**360**

Present-day approachs to the creation of systems of forests inventory and monitoring of the available natural reserves are based on the use of materials of remote sensing and on instrumental field measurements taken by statistical sampling methods of research. Beginning in 2005, the laboratory for forest monitoring and certification of the Ukrainian Research Institute of Forestry and Forest Melioration has been carrying out studies aimed at developing such methods. Information obtained during the inventory makes it possible to fairly assess the condition of forest stands, their structure, natural composition, natural regeneration and biodiversity [157, 158, 159].

2.2.3. Priorities aimed at supporting work on the *in situ* conservation of genetic resources

The conservation of biodiversity at a population-specific level implies the conservation of individual species under natural conditions of their existence. The emphasis is made on endangered species that are a prime consideration in conservation the biodiversity at the national and global levels. With this object in view, one is going to take measures intented to conserve species that are included in The Red Book of Ukraine and in international lists of rare and endangered species with due regard for requirements of international conventions signed by Ukraine. The conservation of species under

conditions of their natural habitat has to be effected all over the territory of Ukraine, irrespective of the conservation status of a land plot. In this connection it is necessary to improve the national legislation in terms of the conservation and sustainable use of species and from the standpoint of control over the enforcement of this legislation upon lands belonging to users and owners of different forms of ownership.

Below are listed priorities for future research on the *in situ* conservation of genepool and for environmental protection measures:

- the conservation of genetic diversity of species and subspecies (races, forms, ecotypes) as such that are of self-sufficinency value;
- the genetic research on the variability of woody species at individual, group-wide and population levels;
- the study of the structure and state of natural forest trees populations and their heredity properties;
- the development of strategies on the *in situ* conservation of genepool of forest species.
- the development of recommendations on the renewal of existing units of conservation that are at final stages of succession;
- the ecologically balanced use of components of biodiversity.

Basic obstacles to the improvement of genetic programs of the *in situ* conservation in Ukraine are listed below which are to be overcome:

- the lack of appropriate public interest,
- the lack of explained information on the necessity of conserving genetic resources and an inadequate level of public awareness,
- a low level of nature-oriented and environmental awareness at all levels of the contemnporary Ukrainian society in relation to issues of the conservation of biodiversity;
- the unsufficient system of development of decision-makers in the field of wildlife;
- the fragmentary nature of information and its limited provision to the public in relation to most programs on increasing the level of environmental awareness and on the conservation of biodiversity;
- the lack of financial resources and state-run programs.

2.3. The State of *ex situ* Genetic Conservation

2.3.1. The *ex situ* genetic conservation in provenance tests

About 100 years ago, the first work on the *ex situ* conservation of forest genetic resources was started in connection with creating provenance test plots and studying the geographic variability (see Table 7). The history of creating provenance test plots of forest woody species in Ukraine includes the following stages:

- the beginning of the last century – the creation of provenance test plots: Scotch pine in 1912 (V.D.Ogiyevsky [37], English oak in 1916 (F.S.Machisky) [38], Scotch pine, English oak, common ash in 1928 -1931 (A.I.Kolsnikov, V.V.Gursky) [160, 161],
- 1970s – the all-USSR network of provenance tests of Scotch pine, English oak and stone pine (I.M.Patlay et al., K.K.Smaglyuk) [39, 162, 163].
- 1980s - provenance test plots of introduced species (western yellow pine, blue spruce, ground cedar (P.I.Molotkov et al.) [164].
- 1990s and the beginning of the 21th century - provenance tests of the second and third generations of pine, oak, spruce (Yu.I.Gayda, V.P.Samoday, S.A.Los) [165, 166, 167].

As a result, the forest-seed zoning and seed transfer limits was developed for 7 forest species [168] (Annex C):

- Scotch pine- 6 forest-seed ranges, 9 subranges;
- Norway spruce - 3 forest-seed ranges, 5 subranges;
- European larch - 2 forest-seed ranges, 3 subranges;
- common silver fir - 4 forest-seed ranges, 10 subranges;

- English oak - 9 forest-seed ranges, 6 subranges;
- European beech - 6 forest-seed ranges, 15 subranges;
- Crimean beech - 1 forest-seed range, 3 subranges .

The most promising provenances have been selected. 7 population breeds have been suggested to create forest plantations artificial stands. Table 12 presents data on provenance tests of economically valuable forest species.

Table 12. Provenence tests and clonal archive

Scientific name	Native (N) or Exotic (E)	Collections, provenance tests		Clone banks	
		No. stands	No. acc.	No. banks	No. clones
Pinus sylvestris	N	17	628	3	63
Pinus pallasiana (Pinus nigra ssp. pallasiana)	N, E	1	33	-	-
Pinus sibirica	E	1	35		
Pinus korainsis	E	1	7		
Pinus pumila	E	1	10		
Pinus ponderosa	E	1	40	-	-
Larix sp.	N	1	15	-	-
Picea pungens	E	1	10	-	-
Picea abies	E	1	25	-	-
Juniperus virginiana	E	1	40	-	-
Quercus robur	N	9	174	-	-
Fagus sylvatica	N	1	70	-	-
Fraxinus excelsior	N	1	112	-	-
Fraxinus oxycarpa	N	1	2	-	-
Total		**38**	**327**	**3**	**63**

Note: data on some plantations were obtained on the basis of research that were carried out over 20 years ago. To reveal a present-day status of plantations, special investigations are necessary.

2.3.2. The plus trees genepool conservation in progeny tests and clone collections.

Work on the conservation of plus trees and tests of their progenies were started in Ukraine in 1950s by the selection laboratory of the Ukrainian Research Institute of Forestry and Forest Melioration under the leadership of S.S.Pyatnitsky. The first progeny test of English oak was created by N.I.Davydova in 1958, and the first progeny test of Scotch pine by S.M.Prylutska in 1962.

First clone collections of Scotch pine and oak were established in 1969.

In today's Ukraine, there are 146.8 ha of progeny tests of 4 species. More than a thousand progenies of plus trees are being tested (Table 13).

2.3.3. The number, size and functions of arboretums and botanical gardens in Ukraine

Under present-day conditions, arboretums and botanic gardens of Ukraine have a dominant role in the conservation of biodiversity and in the activization of work to introduction of species. The number and area of botanical gardens, arboretums and parks, monuments of landscape architecture in Ukraine are presented in Table 7.

To identify basic areas of research to be conducted by botanic gardens and arboretums in the territory of Ukraine, there was established a Council of Botanic Gardens and Arboretums of Ukraine

attached to the General Biology Branch of the National Academy of Sciences of Ukraine. This council is at once an academic board on problems of "Introduction and acclimatization of plants". The council publishes a journal "Introduction of plants" containing research papers written by staff members of the Councils's network, information on the Council's organizational work, resolutions taken by its sessions, etc.

Table 13. Progeny tests and clone collections

Species		Field collections			
		Progeny tests		Clone banks	
Scientific name	Scientific name	No. stands	No. acc.	No. stands	No. acc.
Pinus sylvestris	N	76	520	35	1029
Pinus pallasiana (Pinus nigra ssp. pallasiana)	N	6	90	1	36
Picea abies	N	1	14	-	-
Quercus robur	N	21	365	16	540
Quercus petraea	N	2	90	2	30
Robinia psevdoakacia (masted form)	E	-	-	1	20
Acer pseudoplatanus	N	-	-	1	10
Total		**106**	**1079**	**56**	**1665**

The council deals with a wide range of issues, specifically related to the conservation of the plants genepool in botanical gardens and arboretums of Ukraine, namely:

- puts forward legislative initiatives and suggestions before different branches of government in relation to the protection and conservation of collections in botanic gardens and arboreta,
- organizes work on creating a unified database for collections of the botanic institutions,
- takes measures on the protection of rare, disappearing and endemic plants as well as other groups of plants,
- carries out scientific conferences, seminars, expositions and competitions on the most urgent theoretical and applied issues, contributes to publishing related materials,
- provides a methodical guide to botanic gardens and arboreta.

Members of the Council are, on a voluntary basis, representatives of botanic gardens and arboreta located in the territory of Ukraine, irrespective of their departmental affiliation as well as individual biologic and botanic institutions.

At the present time, 29 botanic gardens (of which 17 are of nation-wide significance) and 19 arboretums (13 of which are of nation-wide significance) are registered with the Council (Annex D) [169].

2.3.4. Current programs on the *ex situ* genepool conservation.

Present-day programs on the *ex situ* conservation of genepool are part of breeding programs and provide for two levels of conservation: a population level and an individual level.

The population level comprises:

- the creation of collections of populations;
- the creation of provenance tests and progeny tests of plus stands;
- the research of the structure of populations and dynamics of growth and qualitative indices;
- the study of the variability of growth-related indices and reproductive features in provenance tests and in progeny tests;

The individual level comprises:

- the vegetative reproduction of selected plus trees and the creation of clones collections;
- the seed reproduction of selected plus trees and the creation of progeny tests and seedling seed orchards;
- the investigation of variability of growth-related indices , quality and reproductive features in progeny tests.
- the singling out of elite trees after considering the results of progenies testing and seedling seed orchards.

All the existing *ex situ* collections are registered with respective scientific institutions, and only seed orchards are registered with the State Forest Seed Inspections. Each plantation is assigned a certificate, with its copies being kept by scientific institutions and forest enterprises. Based on recommendations of scientists, forest enterprises, whose territory contain units of conservation, take at regular intervals appropriate managemental measures to keep these units in good conditions. For the lack of funding such measures are not always taken in time.

The following measures are being taken with a view to promote the *ex situ* conservation of resources:

- the development of legislative instruments, regulatory documents, guidelines and practical recommendations;
- the submission of papers to scientific, popular scientific and social print media;
- the arranging of guided tours;

Basic obstacles to the improvement of the *ex situ* conservation of genepool in Ukraine are listed below:

- resource insufficiency (professionals, funds);
- the collections are not protected (provenance and progeny tests) that are not considered to be of importance;

Priorities for measures to be taken in the future on the *ex situ* conservation of genepool in Ukraine are below:

- the researches on existing units of the *ex situ* conservation*;*
- the renewal of existing collections;
- the creation of new collections;
- the development and implementation of a mechanism of the State-run protection for the units of *ex situ* genetic conservation as well as measures to keep the units of conservation in good state.

For the conservation of the genepool of forest species in Ukraine (rare and disappearing species; targeted commercially valuable forms and varieties, etc.), the Ukrainian Research Institute of Forestry and Forest Melioration, National Forestry Engineering University of Ukraine, National University of Bioresources and Nature Management of Ukraine, and National Botanic Garden are using the micropropagation simultaneously with classical methods of reproduction. For economic or ecological expectations to be achieved, the use of micropropagation technologies must be supported by the State. What is more, it is necessary to recruit high-skilled specialists and to ensure an appropriate level of the financing of fundamental research work and a proper collaboration between science and production operations.

2.4. The State of Use and Sustainable Management of Forest Genetic Resources.

The State Forest Resources Agency of Ukraine and the State Forest Seed Inspection did not cooperate with other countries on transfer of forest seeds. No reports are kept on this field. There is no relevant information.

2.4.1. Forest improuvement programs

Research on forest improvement in Ukraine has been carried on since 1920s [170, 171]. The forest improvement programs were directed towards to increase the productivity of stands, in the yield

level of walnuts and soft resin as well as towards the creation of energy plantations and protective stands under unfavourable climatic conditions (see Table 14).

The individual and mass selection that are based on research on the variability of forest tree species at individual and population levels was used by S.S.Pyatnitsky in 1950s as the basis for working out the principles of elite seed-growing или in Ukraine [153]. The further development of this line is closely related to the creation of a permanent seed-growing base and to the conservation of genepool [28 , 41, 43, 144]

Since 1930s, researches have been carried out on the intraspecific hybridization of forest species. For example, S.S.Pyatnitsky and S.Y.Khmaladze obtained valuable hybridous forms of oaks [29, 172, 173], P.I.Mlotkov and V.A.Illin – those of pines [134], N.V.Starova – those of poplars [174], F.L.Shchepotyev, P.P.Badalov, N.Ya..Krivobokova – those of walnut, and F.A.Pavlenko – those of hazel-nut [175, 176, 177].

Over the last 30 years, 46 breeds of 12 species and hybrids of forest trees have been included in the State Register of plant breeds [181].

Table 14. Forest improuvement programs.

Species		**Improvement programme objective**					
Scientific name	**Native (N) or introdused (E)**	**Timber**	**Pulpwood**	**Energy source**	**MP***	**NWFP ****	**Other**
Pinus sylvestris	N	√			√		resine
Pinus pallasiana (Pinus nigra ssp. pallasiana)	N	√			√		agroforests
Pinus nigra (Pinus nigra ssp. nigra)	N	√			√		agroforests
Corulus avellana						√	
Picea abies	N	√					
Larix kaempferi	E	√	√				
Larix decidua	N/E	√	√				
Larix sibirica	E	√	√				
Abies alba Mill.	N	√					
Pseudotsuga Menziesii	E	√			√		
Juglans regia	E	√				√	
Juglans nigra	E	√					
Populus nigra	N	√	√	√			
Quercus robur	N	√			√		
Quercus petraea	N	√			√		
Quercus pubescens	N	√			√		
Fagus sylvatica	N	√					
Fagus taurica	N	√					

* MP: Multipurpose tree improvement program
**NWFP: Non-wood forest product

2.4.2. Forest seed-growing and improved seeds using

The principles of elite seed-growing developed by S.S. Pyatnitsky [153] found their way to practical application in the creation of a permanent seed-growing base of clonal seed orchards and seedling seed orchards. Since the beginning of 1960s, for example, 1195,4 ha of seed orchards of forest tree species have been created in Ukraine, among them 1007,6 ha of clone seed orchards and 187,8 ha of seedling seed orchards. Of this amount, 1014.4 ha of seed orchards are registered by the State Forest Seed Breeding Inspection (see Table 15).

Table 15. Seed orchards

Species (scientific name)	Clonal seed orchards		Seedling seed orchards
	Generation	Area, ha	Area, ha
Pinus sylvestris	I	533,5	96,6
Pinus sylvestris	II	39	0
Pinus pallasiana (Pinus nigra ssp. pallasiana)	I	35,1	9
Picea abies	I	20,4	3,8
Larix decidua	I	49,4	0
Abies alba Mill.	I	25,3	0
Pseudotsuga Menziesii	I	10	0
Quercus robur	I	281,8	60,4
Quercus robur	II	11,2	0
Quercus rubra	x	x	2
Fagus sylvatica	x	x	16
Fraxinus excelsior	I	1,9	0
Total		**1007,6**	**187,8**

As of 01.01.2012, the amount of seeds collected at units of the permanent seed-growing base of Ukraine made up 255 248 kg, or 25.4 % of the total volume of extracted forest seeds. There is no information on the improved reproductive material of other species.

For effectively use of available units of the permanent and to create new units seed-growing base in order to increase the provision of improved reproductive material, "A sector-specific program on developing the forest seed management for the years of 2010-2015" was approved [156] in the framework of objectives stated in the State-run targeted program "Forests of Ukraine" [**Error! Bookmark not defined.Ошибка! Закладка не определена.**], identifying basic directions in the development of forest seed-growing.

Sufficient quantities of seeds, pollen, grafts and/or other reproductive materials for Scotch pine and English oak are available upon request. The improved reproductive material of Scotch pine may be available in commercial quantities.

Aaccordance to the Law of Ukraine from 26.12.2002r. ¹ 411 – IV «About seed and planting material» (in the release of Law ¹ 5397-vi from 02.10.2012) [178] reprodukting material (seed) is distributed after categories:

- underbase seed are seed of primary lanocs of nasinnictva which is used for his subsequent reproduction and receipt of base seed;
- • base seed are seed, got from successive reproduction of underbase seed;
- • the certificated seed are seed, got from successive reproduction of base seed.

According to a sector-specific standard [179], forest seeds fall into the following categories:

- normal seeds: seeds collected from normal stands and from temporary and permanent forest seed stands;
- improved seeds: seeds harvested from plus trees and best normal trees of forest stands with unknown pollinators;
- certificated seeds: seeds produced by plus trees clones as a result of targeted pollinating with purposefully selected pollinators;
- elite seeds: seeds obtained during the cross-pollination among elite trees clones that have being under control over their seed generation;
- hybridous seeds: seeds harvested from the hybridization of plants of individual species and forms in special plantations, with these seeds being characterized by the phenomenon of heterozis.

The number of seedlings that are grown from seeds which were extracted from units of the permanent seed-growing base averages 18 millions over the last 3 years.

2.4.3. The information support

The informational support to measures on the rational use, development and consevation of genetic resources of Ukraine is efected through discussions concerning the most important issues of the above directions by a collegiate organ of the State Agency for Forest Resources of Ukraine, with the issuance of appropriate orders, or by permanent/provisional advisory organs (a Scientific and Technical Council).

At present, informational systems of the State Agency for Forest Resources of Ukraine and of the State Forest-Seed Inspection concerned with the rational use, development and consevation of genetic resources of Ukraine are still only partially computerized.

Comprehensive computerization of these systems will allow keeping the electronic documentation in standard formats (Word, Excel) and provide free exchange of data. A unified State-run system of electronic registration of data of forest genetic resources units in Ukraine is developing now.

At the level the The State Forest Resources Agency of Ukraine and the State Forest Seed Inspection, there are no contracts concluded with foreign countries in fields associated with the genetic conservation or with an extended access to forest genetic resources that are located outside Ukraine.

2.5 The State of National Programmes, Research, Education, Training and Legislation

2.5.1. National programs

The State-run program “Forests of Ukraine for the years of 2010 -2015” is now in force in Ukraine [4]. This program provides for the conservation of biodiversity of forests and is based on principles of sustainable forest management and rational use of forests. Also there are some multinational programs involving individual regions as exemplified by “The framework convention on protection and sustainable development of the Carpathians”.

A sector-specific program on the development of forest seed management for the years of 2010-2015 [156] is aimed at widening of the forest-seed base, specifically at conservation, reproduction and rational use of the valuable genepool of forest woody species. For example, the following measures are planned under this program:

- selecting of 1260 plus trees of 9 species.
- creating clone plantations on the area of 535 ha for 8 species and seed orchards on the area of 975 ha for 7 species;
- selecting and creating permanent forest-seed stands of 13 species on the area of 650 ha.

2.5.2. Institutions concerned with the conservation and using of forest genetic resources

An active participation in the conservation of forest genetic resources is taken by the Ukrainian State Forest-Seed Inspection, Ukrainian Research Institute of Forestry and Forest Melioration, Ukrainian Research Institute of Mountain Forestry, National Ukrainian University of Forestry Engineering, National University of Bioresources and Nature Management of Ukraine and other research institutions and higher educational institution (see Table 16). All this activity is under the general supervision of the State Agency of Forest Resources of Ukraine.

Investigations on the conservation of genetic resources are annually financed by the State Agency of Forest Resources of Ukraine to the extent of UAH 1 million.

No special financial provisions are made for the conservation of genetic resources.

Table 16. Institutions involved with conservation and use of forest genetic resources.

Name of Institution	Type of Institution	Activities or Programs	Contact Information
1	2	3	4
Ukraine State forest Recourses Agency	The central executive authority of Ukraine on forestry, hunting management, hunting and hunting dog breeding	government regulation and control in forestry and hunting	01601, Kyiv, SH. Rustaveli str., 9-a tel.: +38 (044) 235-56-20, 235-44-09 fax: +38 (044) 235-44-09 E-mail: admin@dklg.gov.ua; nauka@dklg.gov.ua
Ukraine State Forest Seed Inspection	State Institution	management and control in forest seed growing	08150, Kyiv region., Boyarka, Lisodoslidna str., 14, tel.: +38 (04598) 3-52-97 fax: +38 (04598) 3-52-97 E-mail: ukr_dli@ukr.net
Ukrainian Research Institute of Forestry and Forest Melioration named after G.M. Vysotskij	Research institution	Tree improu-vement, deve-lopment and research faci-lities of gene pool conservation	61024, Kharkiv, Puchkinska str. 86, tel./fax: +38 (057) 704-10-02 E-mail: uriffm@uriffm.org.ua; selint@uriffm.org.ua
Ukrainian Research Institute of Mountain Forestry named after P.S. Paspernak	Research institution	Tree improu-vement, development and research facilities of gene pool conservation	76018, Ivano-Frankivsk Grushevskogo str. ,31, tel./fax +38 (03422) 2-52-16, +38 (0342) 55-24-57, +38 (03422)2-52-40. E-mail: ukrrimf.inf@ukr.net
National Ukrainian University of Forestry Engineering	The educational and research institution	Tree improu-vement, development and research facilities of gene pool conservation	79057, L'viv, General Chuprinka str., 103 tel: +38 (032) 237-80-94 fax: +38 (032) 237-89-05 E-mail: nltu@ukr.net
National University of life and environmental sience of Ukraine	The educational and research institution	Tree improu-vement, development and research facilities of gene pool conservation	03041, Kyiv, Geroiv oboroni str., 15. tel.: (44) 527-82-33. E-mail: rectorat@nauu.kiev.ua
National botanical garden named after M.M. Grishko NSAU	Research institution	gene pool of endangered and exotic species conservation	01014, Kyiv, Timiryazeva str., 1. tel: +38 (044) 285 41 05 Факс: +38 (044) 285-26-49 E-mail: nbg@nbg.kiev.ua

Continuation of the table 16

1	2	3	4
Institut of botany named after Kholodny NSAU	Research institution	gene pool of endangered species conservation	1, 01601, Kyiv, Tereschenkivska str. 2, tel: +38 (044) 2344041 fax: +38 (044) 2344041 E-mail: inst@botany.kiev.ua
Vasyl Stefanyk Precarpathian National University	Educational and research institution	Tree improu-vement, development and research of facilities gene pool conservation	76000, Ivano-Frankivsk, Galitska str.,201 tel: +38 (03422)596172 E-mail:klz.pu.if.ua@ukr.net
Easterneurope State University after lesya Ukrainka	Educational and research institution	gene pool of endangered species conservation and studiing	43025, Lusk, pr. Voli, 13, tel: +38 (03322) 4-84-31, fax: +38 (03322) 4-10-07

2.5.3. Forest education

Information on Ukraine's available genetic resources is provided to students of forestry colleges and universities.

There are the following colleges of forestry profile in Ukraine: the Technological college of the National Forestry Engineering University of Ukraine; Carpathian forestry engineering college; the Malin forestry engineering college; Lubny forestry engineering college; Chuguyev-Babchansk forest college; Kremenets forestry engineering college; Berezniv forestry engineering college, Storozhinets and Carpathian forest colleges. Around 1600 graduetes are qualified as junior specialists every year.

The most important higher educational institution of forestry profile are the National Forestry Engineering University of Ukraine, National University of Bioresources and Nature Management of Ukraine. Besides, 20 universities of general and agrarian profile have forestry faculties or departments that teach disciplines related to forest genetic resources and their conservation. The graduates of higher educational institution are awarded bachelor's, specialist's or master's degrees.

The National Forestry Engineering University of Ukraine, National University of Bioresources and Nature Management of Ukraine, Carpathian National University, Ukrainian Research Institute of Forestry and Forest Melioration, and Ukrainian Research Institute of Mountain Forestry run postgraduate training programs in forest-related specialties.

Furthermore, around 1200 forestry professionals upgrade their skills every year in the training centre "Ukrcentrkadrylis" (the town of Boyarka, Kiev region) and in the Carpathian regional training centre (the city of Ivano-Frankivsk).

2.5.4. The legislation on forest genetic resources of Ukraine

The conservation of genetic resources of Ukraine is regulated by many legislative and normative documents. Framework is established by the Forest Code of Ukraine ((FC, the main forest act of the country). The last edition of the FC was approved by the Parliament in 2006 [180].. According to the Article 39 of the FC, a forest land plot can belong to one of 4 categories according to its environmental and socio-economic functions. Additionally, an extra-category status of "especial protection" may be assigned to a plot.

Article 70 of the FC declares obligations to conserve seed and superior ("plus") trees on harvesting areas. This Article declares also a framework mechanism of exceptions from the obligations.

Article 83 sets that ".. to increase forest stand productivity and quality, forest owners and forest stewardship holders conduct measures on … 3) implementation of forest tree breeding, seed growing and variety testing of economically most valuable forest tree species.."

Article 85, for the first time in Ukraine, introduces into forest legislation frame conditions for biodiversity conservation, which "… is carried out by forest owners and forest stewardship holders at genetic, species, population and ecosystem levels by the ways of: 2) allocating, creating and conserving the units of the valuable genepool of forest species (gene reserves, plus stands and plus trees, clone collection of forest trees, seed orchards, forest stands for scientific purposes and tests, etc.); 3) prevention of genetic pollution of native species gene pools and invasions of introduced species into natural ecosystems;…"

The legislative documents in the forest sector adopted in furtherance of FC provisions regulate various aspects of genetic conservation. For example, in 2007 the Cabinet of Ministers states in Article 5 that "… a category of nature protective, scientific and historic-cultural forests is assigned also to forests unique by their species composition, productivity and genetic properties…". Article 6 of the Annex 5 of the "Procedure..." sets norms for assigning especially protected status to forest plots of especial economical / management value including seed stands, nut-, fruit- and berry-production stands, research plots, *etc*.

According to Article 11 of FC on "A procedure of special use of forest resources" approved in 2007, in the process of final harvesting, survival of natural regeneration and young threes of economically valuable tree species has to be ensured, and felling valuable and rare (Red Listed in Ukraine) tree and shrub species, seed and "plus" trees is forbidden.

"Procedure for issuance of special permits (licenses) for using forest resources" approved by the CoM also in 2007 sets standard forms of the licenses. The felling license form contains a separate line "Forbidden to fell:…", where data on objects to be conserved on a harvesting area are provided including seed and "plus" trees, *etc*.

Rules for final harvesting" (CoM, 2010): Article 1.3 sets that "in the process of timber harvesting, felling valuable and rare (Red Listed in Ukraine) tree and shrub species, seed and "plus" trees and other trees of importance crucial for conservation of biodiversity is forbidden". The norm is emphasized again in the Articles 2.6 and 2.7 for shelterwood and clearcut harvesting systems.

The same norm is provided by the Article 5 of the "Rules for final harvesting in Carpathian mountainous forests" (CoM, 2008). This document emphasizes also a need to link harvesting interventions within shelterwood systems to good seed crop years of relevant tree species.

"Rules for forest regeneration", approved by the CoM in 2007: Article 32 declares that "seed of forest tree and shrub species for re-forestation purposes are to be collected from Permanent Seed Growing Base units and from high-productive stands". Article 33 sets that "Seed and planting material of forest tree and shrub species have to meet requirements of forest seed zoning and State Standards".

Industrial Standard 56 35-78 "Forest seed stands of Scots pine, Norway speuce, common oak and larch. Selection and maintenance" provides technical requirements for selecting and establishing relevant seed stands. Draft of a new version of the document has been developed and is under process of approval. A new draft version of this document has been developed and is now in the approval stage.

Some other documents of forest sector can indirectly be linked to FGR conservation

Phytosatinary rules in Ukraine regulate movement of reproductive material at species level, but not intra-specific categories.

Legislation on plant variety control corresponds to UPOV-1991 with later amendments. There is no variety of forest tree species registered in Ukraine. 46 variety of 13 forest species were included in the State Register for Plant Breeds up to 2002 [181]. In next years, these variety were excluded from the Register for failure to pay for maintaining them in the Register.

The most comprehensive norms for conservation of FGR are described in the "Guidelines on Forest Seed-Growing" published in 1993 [168].This document contains guiding principles for the creation and using of the Permanent Seed Growing Base, from primary selection of valuable genotypes and stands through establishment of clonal banks, seed orchards, progeny and provenance

tests to recommendations on seed crop stimulation, forest seed zoning, and, partly, variety testing for forest tree species. Provisions of the document were used partly in other forest sector legislative and regulatory documents, including listed above. Unfortunately, the document has only recommendation force thus a process of updating it and submission for an approval as a fully valid part of forest legislation.

Although there are no strategies of conserving the genepool, some approaches have been recently suggested for the development of such strategies [147, 123, 145]. For example, the following documents have been developed: "A concept of the conservation and sustainable using of forest genetic resources in Ukraine"[147], "Guidelines on the allotment, conservation, and reproduction of the valuable genepool of forest tree species in Ukraine" [182], and "Regulations on the allotment, conservation and sustainable using of the genepool of forest tree species in Ukraine" [149].

Table 17 shows priority directions for the development of the legislation on forest genetic resources in Ukraine.

Table 17. Needs for developing of 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 resources 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			√	

2.6. The State of Regional and International Collaboration

Ukraine participated to works on the conservation of forest genetic resources within the EUFORGEN network (see Table 18).

Table 18 . Overview of the main activities carried out through networks and their outputs

Network name	Activities *	Genus/species involved (scientific names)
Populus nigra Network	Information exchanges Development of technical guidelines Development of shared databases	*Populus nigra*
Social Broadleaves Network	Information exchanges Development of technical guidelines Development of shared databases Establishment of genetic conservation strategies Elaboration, submission and execution of joint research projects	*Quercus robur*
		Quercus petraea
		Quercus rubra
		Quercus pubescens
		Fagus sylvatica
		Fagus taurica
Noble Hardwood Network	Information exchanges Development of technical guidelines	*Acer platanoides*
		Acer pseudoplatanus
		Cerasus avium
		Sorbus torminalis

The level of requirements in international **collaboration** was given in a table 19.

Table 19. **Awareness raising needs/ Needs for international collaboration and networking**

Needs	**Priority level**			
	Not applicable	**Low**	**Moderate**	**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				√

2.7. Access to Forest Genetic Resources and Sharing of Benefits Arising from their Use

Issues related to the access to genetic resources in Ukraine are regulated by the following laws of Ukraine: "The Red Book of Ukraine (of 07.02.2002), "On Plants life"(of 09.04.1999), "On Nature Reserves and Protected Areas of Ukraine"(of 05.06.1992), a Convention on Biological Diversity ratified by the Law of Ukraine of 29.11.1994 (Articles 15, 16), a concept of the conservation of biodiversity of Ukraine (the resolution of the Cabinet of Ministers of Ukraine of 12.05.1997), a Framework Convention on the protection and sustainable development of the Carpathians (the Law of Ukraine of 07.04.2004), a Strategy for the fulfillment of the Framework Convention on the protection and sustainable development of the Carpathians (the resolution of the Cabinet of Ministers of Ukraine of 16.01.2007), a Convention on the protection to the wildlife and natural habitats in Europe (the Law of Ukraine of 29.10.1996), the Green Book of Ukraine (the resolution of the Cabinet of Ministers of Ukraine of 29.08.2002) , and respective national legislative and regulatiry acts, among them those concerned with forest tree species.

A monograph under the editorship of M.V.Chernyavsky [183] highlights the following issues: the availability and reliability of information on forest management; procedural and legal aspects of permissive regulation over forest use; problems of access of communities and small businesses to forest resources; ecological, economic and social problems caused by an unsustainable forest management and illegal cuttings, the impact unsustainable forestry management and illegal cuttings upon the well-being of local forest-dependent communities; ways of preventing and overcoming adverse consequences of illegal cuttings and unsustainable forest management.

Mechanisms of recognition of intellectual property rights concern only those forest genetic resources that have a status of breed.

2.8. The Contribution of Forest Genetic Resource Management to provision of Food security and Sustainable Development

The food industry makes use of introduced types of woody species to obtain walnuts and fruitage (*Juglans regia, Corylus maxima, Castanea sativa*), but their utilization capacity is low and they have a little consequence for the provision of food security.

The using of ameliorative, soil-protective and water-protective functions of forests contributes to the provision of food security of the country. The using of forest genetic resources (the forestry management) promotes the creation of workplaces in the most depressed regions of the country (Polissya, the Carpathian Mountains).

Annex A

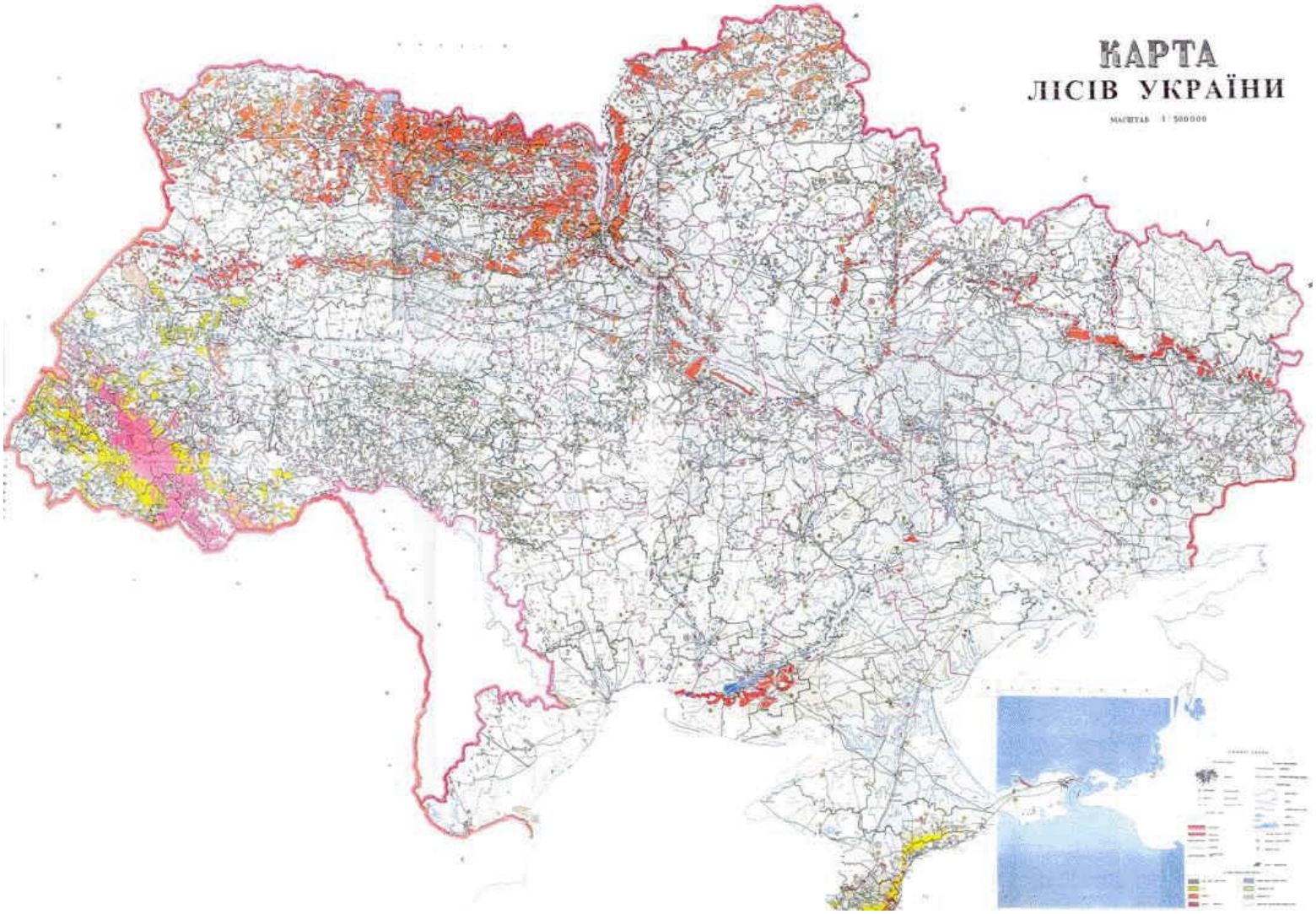
The working group for State Report preparations preparation.

Institution	Persons	Position
1	**2**	**3**
Ukraine State forest Recourses Agency	Mykhajl. M. Dutka	Heat of aforestation department
Ukraine State forest Recourses Agency	Ludmila V.Polakova	Main specialist of department of science, international cooperation, and public cooperation
Ukraine State Forest Seed Inspection	Oleksiy A.Sapiton.	Vice head of inspection
Ukrainian Research Institute of Forestry and Forest Melioration named after G.M. Vysotskij (URIFFM)	PhD.Svitlana A.Los	Head of laboratory of forest tree breeding (coordinator)
	PhD.Larisa Tereshchenko	Leading researcher of laboratory of forest tree breeding
	PhD.Roman Volosyanchuk	Leading researcher of laboratory of forest tree breeding
	PhD. Lilia O. Torosova	Senior researcher of laboratory of forest tree breeding
	Victoriya G. Grigor' eva	Researcher of laboratory of forest tree breeding
Vinnisa Forest Research station of URIFFM	PhD. Ihor S. Neyko	Deputy Director, Associate Professor
Kyiv Forest Research station of URIFFM	PhD Grigoriy A. Shlonchak	Head of laboratory of forest tree breeding
	Valentina V. Mitrochenko	Senior researcher of laboratory of forest tree breeding
	Galina V. Shlonchak	Senior researcher of laboratory of forest tree breeding
Krasnotrostynecky department of URIFFM	PhD.Viacheslav P. Samoday	Senior researcher
Precarpathian National University named after Vasyl Stefanyk Ukrainian Research Institute of Mountain Forestry named after P.S. Paspernak (URIMF)	PhD. Roman M. Yatsyk	Professor of chair of forestry Leading researcher of laboratory of aforestation
Ukrainian Research Institute of Mountain Forestry named after P.S. Paspernak (URIMF)	Dr. Yurij I.Gayda	Leading researcher of laboratory of aforestation
	Vasyl S. Fennich	Head of Transkarpathian departement of URIMF
National Ukrainian University of Forestry Engineering	PhD. Ruslan M. Grechanik	Senior lecturer of chair of forest plantation and breeding
	PhD. Mikola V. Chernyavsky	Senior lecturer of chair of ecology

Продовження Annex A

1	2	3
National University of life and environmental sience of Ukraine	Dr. Yaroslav D. Fushilo	Professor of chair of aforestation
Boyarska Research station of National University of life and environmental sience of Ukraine	PhD. Margarita V.Sbitna	Senior researcher
National botanical garden named after M.M. Grishko NASU	PhD. Nadiya. M. Trofimenko	Secretary of botanical gardens Senat
Institute of botany named after M.G. Kholodniy NASU	Dr. Pavlo M. Ustimenko	Leading researcher of geobotany department
Вищий навчальний заклад «Надслучанський інститут»	PhD. Nina O.Voloshinova	Head of forest department
Easterneurope State University after lesya Ukrainka	Dr. Vasyl Voytuk	Senior lecturer of chair of forestry and tower gardening
National Natural Park «Sv'aty Gory»	PhD. Pavlina T. Jurova	Vice director of recreation, promotion and environmental education

Annex B
Forest map of Ukraine



Annex C

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

Species (scientific name)	Area (ha) of species' natural distribution in your country if known	Average number of trees per hectare, if known	Proportion of species' natural distribution that is in your country (%)	Distribution in the country: widespread (W), rare (R), or local (L)	Type of threat (Code)	Relict /endemic	Threat category			
							Critically Endangered (CR)	Vulnerable (VU)	Lower Risk (LRed)	Not evaluated (NE)
1	2	3	4	5	6	7	8	9	10	11
1.*Arbutus andrachne* L.	20000 ha	152-191		R	4, 6, 15 (recreation)	relict			√	
2.*Betula borysthenica* Klok.	5000 ha		100	L	3, 4, 8,12, 13	neoendem				√
3.*Betula humilis* Schrank				R	15 (drainage, development of wetlands)	relict		√		
4.Betula klokovii Zaverucha	2 populations	40-50	100	L	2, 3, 7, 8, 15 (recreation, condition change)	endem	√			
5.*Betula obscura* A. Kotula incl. B. kotulae Zaverucha (B. verrucosa Ehrh. Subsp. Obscura (A. Kotula) A. et D. Love)	populations with 2-3 trees			R	3, 4				√	
6.*Caragana scythica* (Kom.) Pojark. (C. grandiflora (Bieb.) DC. Subsp. Scythica Kom.) (степова рослинність)			100	R	4	endem		√		
7.*Cerasus klokovii* Sobko	6 local populations	300	100	R	1, 4, 12, 15 (grazing)	endem		√		
8.*Chamaecytisus albus* (Hacq.) Rothm. (Cytisus albus Hacq.)	local populations	1-4 individual /10 m^2		R	1, 4, 8, 12, 15 (grazing)			√		

Continuation of annex C

1	2	3	4	5	6	7	8	9	10	11
9.*Chamaecytisus blockianus* (Pawł.) Klásk. (*Cytisus blockianus* Pawł.).	local populations	1-14 individual / 100 m^2		R	1, 4, 8, 12, 15 (grazing)	endem			√	
10.*Chamaecytisus graniticus* (Rehmann) Rothm. (Cytisus graniticus Rehmann; incl. Chamaecytisus Skrobi-szewskii (Pacz.) Klask., Cytisus skrobiszewskii Pacz.).	local populations	2 до 10 individual to 1m^2		L	1, 4,5	endem		√		
11.*Chamaecytisus paczoskii* (V. Krecz.) Klásk. (Cytisus paczoskii V. Krecz).	local populations			R	1, 4, 8, 12,	endem		√		
12. *Chamaecytisus podolicus* (Błocki) Klask. (Cytisus podolicus Błocki)	local populations			L	1, 4,5	endem		√		
13.*Chamaecytisus rochelii* (Wierzb.) Rothm. (Cytisus rochelii Wierzb.)	local populations			L	15 (spontaneous succession)				√	
14. *Chamaecytisus wulffii* (V. Krecz.) Klask. (Cytisus wulffii V. Krecz.)	local populations			L	1, 4,5	endem		√		
15.*Crataegus pojarkovae* Kossych	One population	405	100	L	11, 12, 13, 15 (grazing)	endem		√		
16.*Crataegus tournefortii* Griseb. (C. schraderana Ledeb.)	4 local populations	100-150	100	L	4, 15 (recreation)	relict		√		
17.*Cistus tauricus* J.Presl et C.Presl (C. creticus auct. non L., C. incanus auct. non L.)	16000 ha, 80 localities			R	4, 6, 15 (recreation, spontaneous succession)	relict				√

Continuation of annex C

1	2	3	4	5	6	7	8	9	10	11
18.*Daphne cneorum* L.	local population in 2 localities			R	4, 6, 12, 15 (re-creation, sponta-neous succession)			√		
19.*Daphne sophia* Kalen.	local population from от 40 to 1500 individuals			L	4, 7, 15 (збір)	endem	√			
20.*Daphne taurica* Kotov	2 localities with area 61 m^2	256		L	4, 6, 7	endem	√			
21.*Euonymus nana* M. Bieb.	30 local populations with area 0,3 – 20 ha	1-17 individual /$м^2$		R	4, 15 (recreation, spontaneous succession)			√		
22.*Lonicera caerulea* L.	4 localities			L	1, 15(grazing)	relict, endem			√	
23.*Fraxinus ornus* L.	2 ha			L	4, 6,	relict			√	
24.*Juniperus excelsa* Bieb.	1000 ha			R	2, 3, 7	relict		√		
25.*Juniperus foetidissima* Willd.	90 ha (1 population)			L	4,11, 12, 15(grazing)				√	
26.*Larix polonica* Racib. (L. decidua Mill. subsp. polonica (Racib.), L. decidua ssp. carpatica Domin)	520 ha	92		L	3	endem	√			
27.*Nitraria schoberi* L.	local populations			L	1,5,6		√			
28.*Pinus cembra* L.	4200 ha	104		L	3, 4	relict		√		
29.*Pinus cretacea* Kalenicz. (P. sylvestris L. var. cretacea (Kalenicz.) Kom.)				L	3, 4, 12, 15 (recreation, grazing)	relict		√		
30.*Pinus stankewiczii* (Sukacz.) Fomin (P. pithyusa Stev. subsp. stankewiczii (Sukacz.) N. Rubtz.)	3 local populations, розміром 10–30 ha		100	L	3, 12, 15 (recreation)	endem		√		

Continuation of annex C

1	2	3	4	5	6	7	8	9	10	11
31.*Pistacia mutica* Fisch. et Mey. (P. atlantica Desf. subsp. mutica (Fisch. et Mey.) Rech.fil.)				R	4	relict				√
32.*Quercus cerris* L. (Q. austriaca Willd.)	2 localities			L	2, 7, 15 (климатичні)				√	
33.*Rhamnus tinctoria* Waldst. et Kit. (Rh. saxatilis Jacq. subsp. tinctoria (Waldst. et Kit.) Nym.)				R	4 , 12, 15 (grazing)				√	
34.*Rdodendron myrtifolium* Schott et Kotschy (Rh. kotschyi Simonk.)				R	4, 15 (recreation)					√
35.*Rosa czackiana* Besser	local populations – 1 – 5 m^2			R	4, 11, 12, 15 (grazing)	endem				√
36.*Rosa donetzica* Dubovik	local populations – 6 – 200 m^2			L	4, 6,12	endem				√
37.*Ruscus hypoglossum* L. (Platyruscus hypoglossum (L.) A.P.Khokhr. et V.N.Tikhom.)	local populations (diameter less than 10 m)			L	4, 15 (recreation)	relict			√	
38. *Salix. alpina* Scop. (S. Jacquiniana Willd., S. Jacquinii Host.)	one locality on Transcarpathia			L	15 (grazing, recreation, spontaneous succession)	relict	√			
39.*Salix herbacea* L.	isolated populations to 10-300 m^2			L	15 (grazing, recreation, spontaneous succession)	relict			√	
40. *Salix lapponum* L.	numerically small populations			R	drainage, development of wetlands	relict		√		

Continuation of annex C

1	2	3	4	5	6	7	8	9	10	11
41.*Salix myrtilloides* L.				R	15 (drainage, development of wetlands)	relict		√		
42.*Salix retusa* L. (Incl. Salix kitaibeliana Willd.)	isolated populations to 10-500 m^2			L	15 (grazing, recrea-tion, spontaneous succession)				√	
43.*Salix starkeana Willd. (S. livida Wahlenb.)*	numerically small populations			R	4, 6, 8, 12	relict		√		
44.*Sorbus torminalis* (L.) Crantz (Crataegus torminalis L., Pyrus torminalis (L.) Ehrh.)	numerically small populations	1-80	90	R	4, 6, 8		√			
45.*Spiraea polonica Blocki (S. media subsp. polonica (Blocki) Pawl.)*	1 population	200		L	1, 4, 15 (spontaneous succession)	endem	√			
46.*Staphylea pinnata* L.	numerically small populations	150-200	100	R	4	relict			√	
47.*Syringa josikaea* Jacq. fil.	7 local populations	162/100m^2		L	4, 15 (drainage, recreation, diging)	relict		√		
48.*Tamarix gracilis* Willd.	local populations with 3-10 individuals			R	4, 6, 15 (recreation)			√		
49.*Taxus baccata* L.	40 location	10-100	90	R	3	relict		√		
50.*Tilia dasystyla* Stev. (T. Rubra DC. var. Dasistila C. K. Schneid.)		single individuals		L	3, 4	relict	√			

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 Pests and diseases
- 12 Forest fires
- 13 Drought and desertification
- 14 Rising sea level
- 15 Other

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