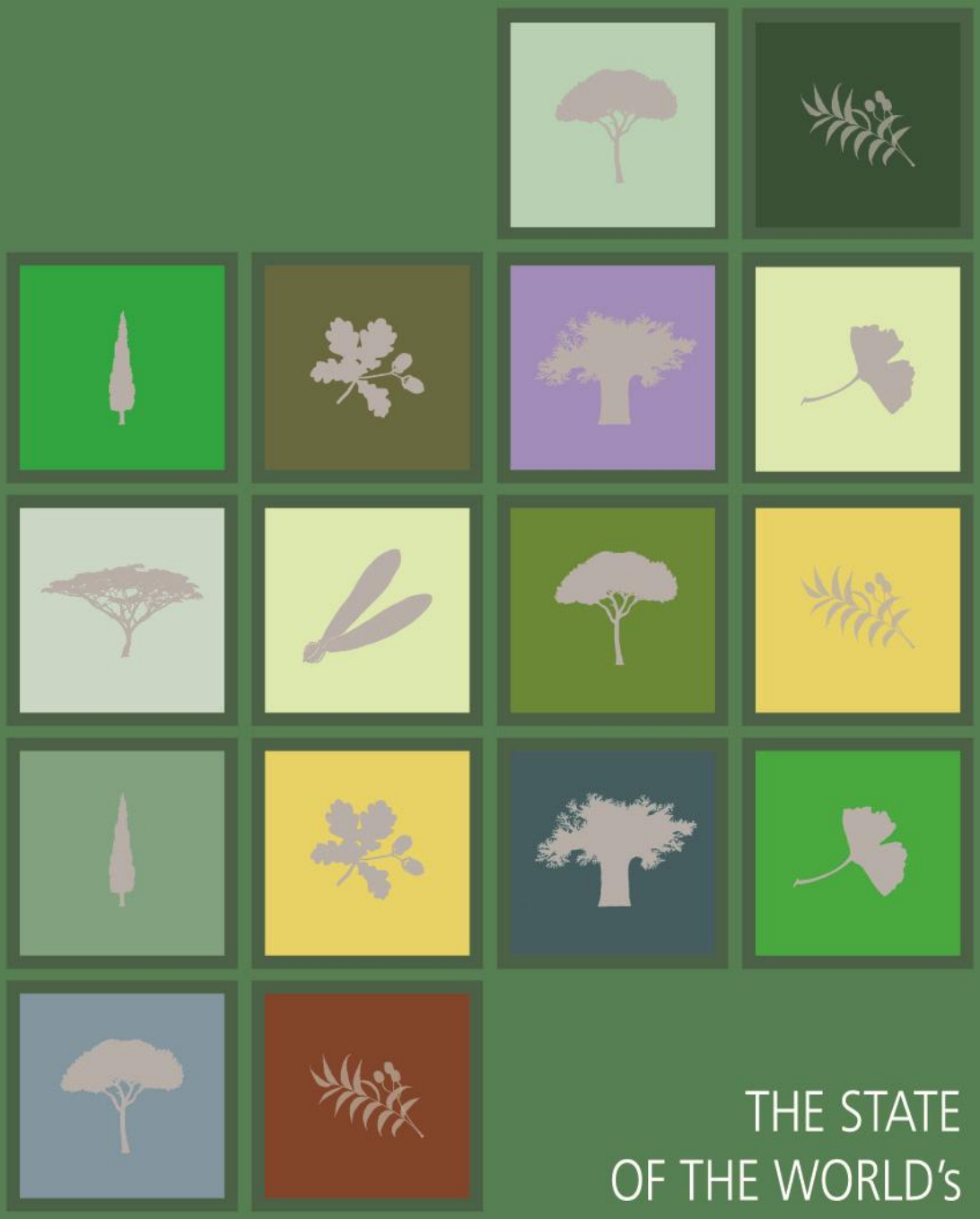

THE STATE
OF THE WORLD's

# FOREST GENETIC RESOURCES

# COUNTRY REPORT

## CYPRUS

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.

# CYPRUS REPORT

# The State of the World's Forest Genetic Resources

Department of Forests
Ministry of Agriculture, Natural Resources & Environment
August 2011

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## A. EXECUTIVE SUMMARY

The ecological and environmental values of the forest resources in Cyprus are much more important than woody products due to the low wood productivity and profitability of forests. Therefore, forests are managed mainly for their ecological value and their indirect benefits (soil erosion control, water supply, biodiversity, carbon sequestration, employment, etc.)

Forest fires, grazing, climate change, desertification, lack of management plan for private forests are the major threats for the forests and the forest genetic resources in the inland. Much effort is paid by the State to overcome these problems.

The conservation of forest genetic resources is achieved, to some extent, through the conservation and management plans prepared by the Department of Forests, which is the manager of the State Forests. However, these plans are prepared for the forest ecosystems and not exclusively for the conservation of forest genetic resources.

The existing *In-Situ* and *Ex-Situ* conservation measures are prepared only for some of the threatened species and further work should be done to the direction of improving the existing capacity of conserving forest genetic resources. Financial issues, lack of personnel and the lack of national university and forest research institutes are some constraints hampering the integrated conservation. Furthermore, inaccessibility of forest areas which are not under the effective control of the Government of the Republic of Cyprus, the lack of a national program and the inappropriate documentation of measures further inhibit the efforts for the conservation of forest genetic resources.

For the improvement of the conservation of the forest genetic resources, a strategic plan should be prepared and should include the following:

- Designation of national coordinator (Institution) and other national stakeholders (Institutes, Universities) for the preparation of the Strategic Plan,
- Preparation of a concrete plan for conserving exclusively forest genetic resources. The plan should include genetic resources mapping and monitoring, priority species, measures and time table. The plan should be incorporated with the management plans which are prepared for forest ecosystems by the Department of Forests,
- Establishment and running of a seed bank and plantations for *Ex-Situ* conservation of forest genetic resources,
- Promotion of the research on the topic of conservation for the most important species. For this purpose, it is necessary to enhance collaboration with universities and forest research Institutes abroad,
- Further education of the personnel dealing with the conservation of forest genetic resources,
- Development of collaboration with other countries for *Ex- Situ* conservation,
- Establishment of a national mechanism for the access to forest genetic resources, fair and equitable sharing of the benefits arising out of their use.

## B. INTRODUCTION TO THE COUNTRY AND FOREST SECTOR

**General facts about Cyprus**

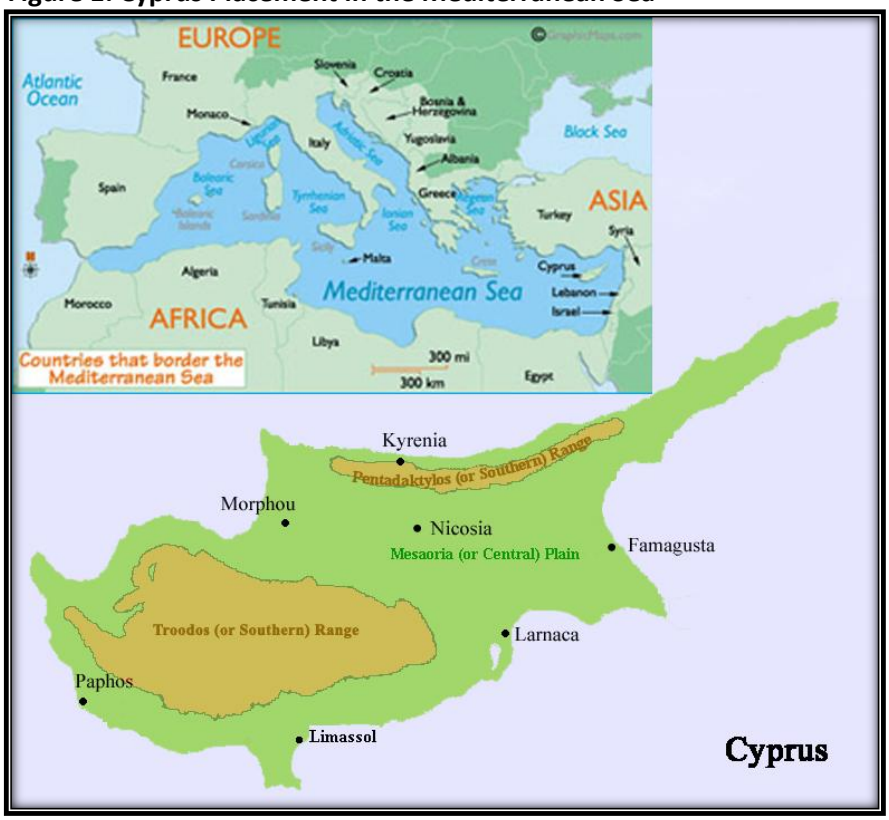
Cyprus is situated in the north-eastern part of the Mediterranean Sea and lies across the boundary of the Euroasian and African continents. The island has an extremely irregular outline, with numerous bays and headlands, and covers an area of approximately 9 251 $km^2$; thus it is the third largest island of the Mediterranean Sea after Sicily and Sardinia.

The outstanding topographical features of Cyprus, which in conjunction with the climate and geology affect the distribution of vegetation on the island, are as follows:

- *The Troodos (or Southern) Range*
  The Troodos massif, located in the west and southwest, consists predominantly of igneous rocks, while along its southern and eastern flanks stretch extensive elevated areas of chalks and limestones. At about its centre, it rises to a maximum elevation of 1 952 m at the peak of Chionistra (Olympos), the highest point of the island; other important high peaks of this range are Madari (1 612 m), Papoutsa (1 554 m), Kionia (1 420 m) and Tripylos (1 408 m), whereas a large part of this range lies above 1 000 m.
- *The Pentadaktylos (or Northern) Range*
  This range is mainly composed of hard limestones and marbles, it has a length of approximately 80 km and extends west to east roughly parallel with and close to the north coast. It rises abruptly in the west, like a high wall, to a maximum elevation at Kyparissovouno (1 024 m), becoming generally lower towards the east and diminishing in the Karpasia peninsula. There are several peaks with elevation between 700 to 900 m, while much of the range lies above 400 m.
- *The Mesaoria (or Central) Plain*
  This broad sedimentary plain extends across the island from Morfou bay, in the southwest, to Ammochostos (Famagusta) bay, in the east, separating Troodos and Pentadaktylos ranges. It is a semiarid treeless plain consisting chiefly of fertile agricultural land; the greatest part of the plain lies at about 200 m, the western part towards Morfou is higher and more diversified with hummocks and ridges whereas the eastern part towards Ammochostos is flatter.
- *The Coastal Belt*
  The island is bounded by a low-lying coastal belt; around Morfou and Ammochostos the coasts are wide and flat becoming very narrow and abruptly rising along the Pentadaktylos range in the north, in the south and west the coastal belt is generally composed of rounded hillsides. Sea-cliffs are confined in the northeast side of the Akamas peninsula and on the northern edge of Troodos range, where the mountains descend abruptly into the sea.

The climate is typically Mediterranean characterised by relatively short, cool winters followed by long, dry very hot summers. However, there is sufficient diversity in topography and micro-climates to allow for a wide diversity of plant communities. The mean annual rainfall over the whole island is about 500 mm; however there is much fluctuation from this figure ranging from less than 400 mm in the Mesaoria plain to over 1 100 mm on the topmost slopes of the Troodos range. Statistical analysis of rainfall in Cyprus reveals a decreasing trend of rainfall amounts during the last century. The climate of Cyprus is not favoured from the Levant coastal weather belt and is drier than the neighbouring regions of coastal Syria, Lebanon and northern Israel. Furthermore, the Troodos massif intercepts the moisture bearing winds from the Mediterranean and causes a pronounced rain shadow effect on its northern foothills and on the central lowlands.

**Figure 1: Cyprus Placement in the Mediterranean Sea**




**Forestry Sector**

The Forest areas in Cyprus are classified in two major groups: a) forests and b) other wooded land (OWL, which includes Maquis and garique), which are either of state or private ownership. These categories account for 41,80% (386 718 ha) of the total land area.

The distribution of forest areas in these groups, as well as the land tenure in relation to the total forest area are shown on *Table 1* below:

**Table 1: Forest Ownership and Area***

| Forest Ownership | | Area (ha) | Area Percent. | Area total (ha) | Area total Percent. |
|---|---|---|---|---|---|
| Public | Forests | 118 843 | 12,85% | 188 388 | 20,36% |
| | OWL | 69 545 | 7,52% | | |
| Private | Forests | 54 010 | 5,84% | 198 330 | 21,44% |
| | OWL | 144 320 | 15,60% | | |
| Total Forest &OWL | | 386 718 | 41,80% | 386 718 | 41,80% |
| Other Land** | | 538 432 | 58,20% | 538 432 | 58,20% |
| Total | | 925 150 | | | |

* Reference year: 2007

** The rest of the island's area (including 3 500 ha of water bodies)

The total cover of **forest areas** in Cyprus (20,36 + 21,44 = 41,80%) is relatively close to the average of the EU (44%), whereas it is much higher than that of North Africa which is only 7%. Conversely, the total **forest cover** of Cyprus (12,85 + 5,84=18,69%) is about half of the average of the EU (36,4%).

Almost all forests areas are either natural (primary - undisturbed by man) or semi-natural. Of the total **forest area**, high forests comprise 44,70%, whereas maquis and lower vegetation such as scrub and phrygana account for 55,30%. Plantations comprise only 2,3%. Although in the past many areas have been planted for fuelwood production, sand dune stabilisation and swamp drainage, especially in coastal areas and lowlands, today most plantations are managed for amenity and other non-marketable benefits. Plantations are mostly composed of exotic species especially *Eucalyptus* spp., *Acacia saligna* and *Pinus* spp., however many indigenous species like *Pinus brutia* and *Cupressus sempervirens* have been used.

On the *Table 2* below, forest characteristics and area are provided.

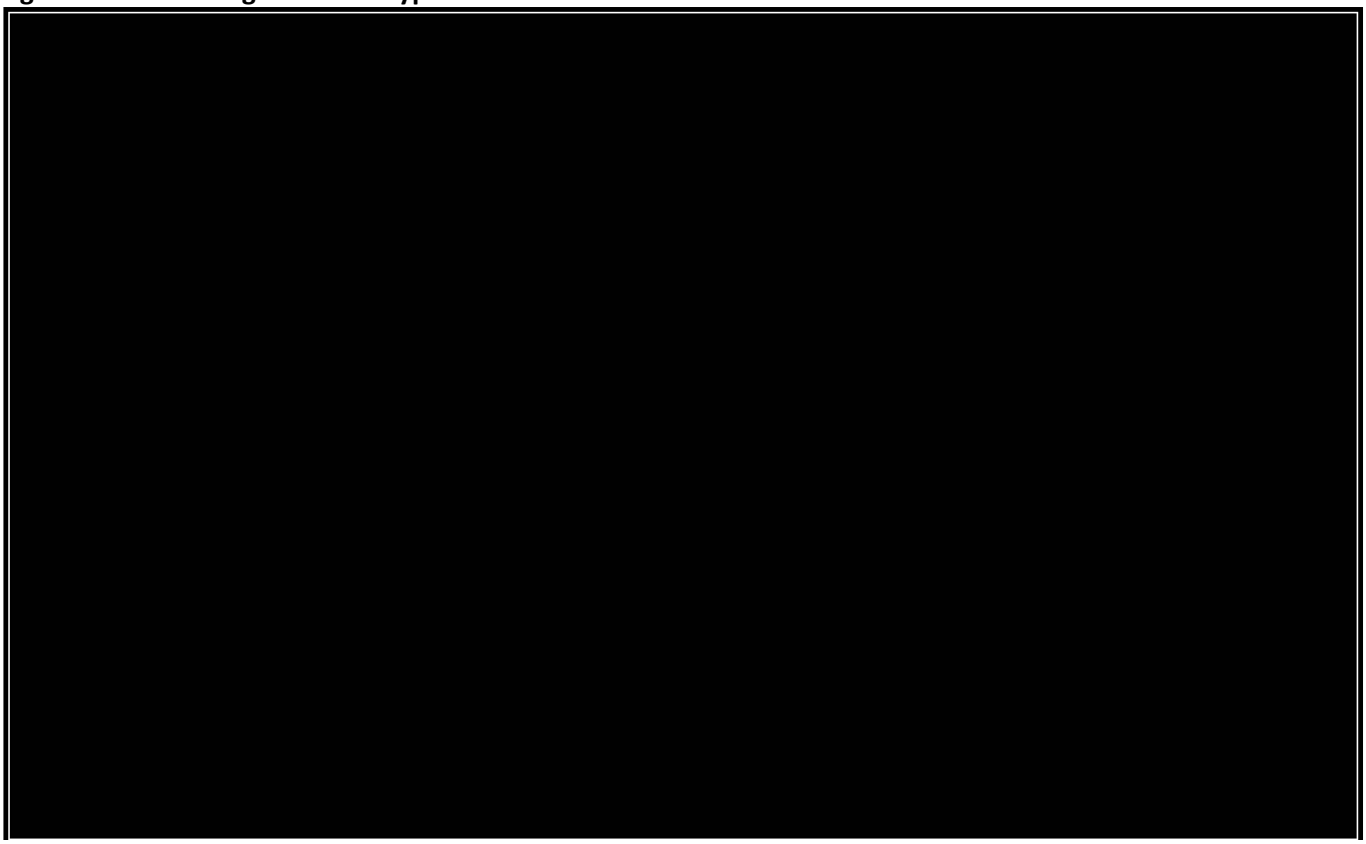
**Table 2: Forest Characteristics***

| Main Forest Characteristics | Area (ha) |
|---|---|
| Primary forests | 13 241 |
| Naturally regenerated forests | 142 658 |
| Planted forests | 30 195<br>(For Reforestation and Afforestation using native and exotic species) |
| Reforestation | n.a. |
| Afforestation | n.a. |

* Reference year: 2007

Forest vegetation is primarily found along the Troodos and Pentadaktylos ranges and along the coastal belt. Forest vegetation is lacking from the central plain of Mesaoria, which is characterised as semi-arid zone with some exceptions. Generally, the extent of forest vegetation is affected by the ecological conditions especially the prolonged dry season.

**Figure 2: Natural Vegetation of Cyprus**



The forest cover in Cyprus shows a trend of small and gradual increase for both state and private forests, whereas other wooded land has not changed since 1990. However, precise evaluation is not possible because reliable estimates regarding private forests and other wooded land became available only after the production of the vegetation map in 1999 (Figure 2), while data regarding State Forests have always been accurate.

The forest cover for the State Forests has not changed for the period of 1990 to 2000, yet it is forecasted to have a slight increase because of allocation of state land (common land) to forestry for afforestation. On the other hand, owing to urbanization and gathering of rural population in towns and coastal areas, private forests have increased as a result of abandonment of agricultural land. This process results in the increase of forest cover but along with the abandonment of traditional activities leads in loss of agricultural and landscape diversity since these areas are gradually colonized by forest vegetation, typically pine forests. Similarly, agroforestry systems have been abandoned on mountainous and hilly areas and only small holdings are under this management

system. The practice of acquiring other land for afforestation, which might be covered by other vegetation types such as grasslands, phrygana or even maquis, may also result in both, the expansion of forest cover while at the same time leading to loss of biological diversity.

State forests and some forested common land are managed exclusively by the Department of Forests, while private forests have never been under management due to the lack of any specific policies towards the regulation of private forestry. It should be mentioned that "private forest holdings" have never been recorded as an income generating unit in agricultural censuses, at least during the second half of the 20$^{th}$ century. This confirms the trend of private forest abandonment and neglect by owners as a result of low profitability and high costs of exploitation.

Private forests consist of holdings of usually very small ownership, having been acquired by inheritance from parents and even grandparents. The forest vegetation grows almost exclusively on former agricultural lands, meadows and pasture, mainly situated on hilly and mountainous areas. Their average size ranges between 2,1 ha in mountainous areas to 4,4 ha in the dry land and vineyard zones. They are scattered in many parts of the island and most of them occur along the delimitation line of the State forests. The unclear land tenure and the holdings' fragmentation have raised inherent problems regarding the establishment of a functional management system of private forests.

**Administration and Policies**

The responsibility of forestry belongs to the Department of Forests, under the Ministry of Agriculture, Natural Resources and Environment. The Department of Forests, administers the State Forests, implements Government Policy with regard to forests and is responsible for implementing plans for forest development (Figure 3). Furthermore, it provides technical assistance and carries out reforestation on private and public land.

**Classification of State Forests**

The management of the State Forests is controlled by the forest law, which has been amended several times since its first enactment in 1879; its last amendment was in 2010. The current Forest Law, 1967-2010, refers mainly to the State Forests but it relates also, though to a far less degree, to Private Forestry and to Forest and Timber Industries that is to say to the whole of the forestry sector.
The total area of State Forests is 163 818 ha (17,71%).

Under the forest law, State Forests are classified as Main and Minor State forests, categories which are also subdivided as shown below:

**Main State Forests**

a. Permanent Forest Reserves
b. National Forest Parks
c. Nature Reserves

**Minor State Forests**

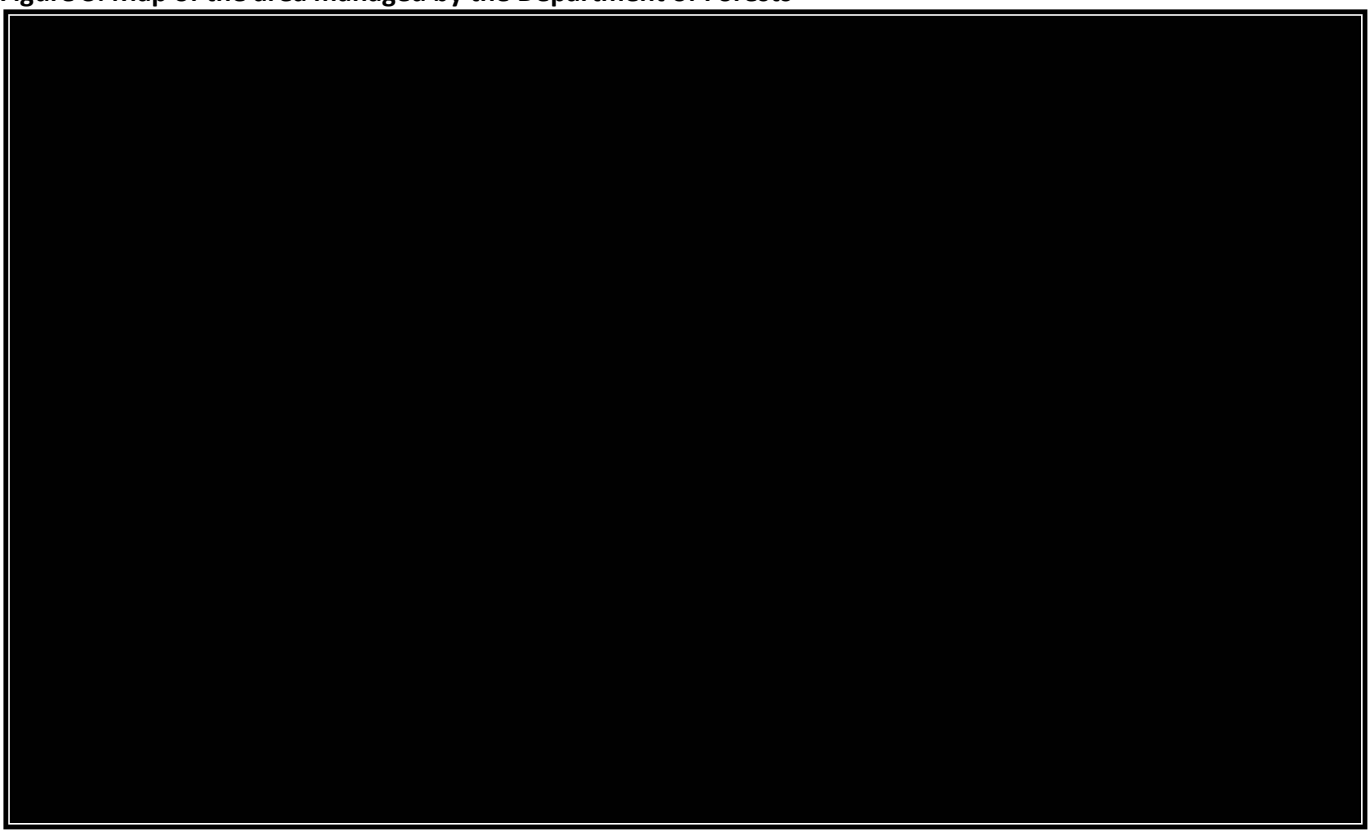
a. Multiple Use Forests
b. Communal Forests
c. Municipal Forests
d. Nursery Gardens
e. Grazing Areas

This classification of forest areas is very important for their effective and sustainable management

**Main State Forests**

These are mainly natural forests which occupy the two mountain ranges – the southern Troodos Massif and the Northern Pentadactylos Range (the latter is now occupied by the Turkish troops). These forests are composed of a variety of natural vegetation including forests of conifers and broad-leaved trees such as pines, cedars, cypress and oaks. However, the dominant vegetation, up to 1 400 m, is Calabrian pine forest (*Pinus brutia*), which comprises the productive forest of the island. At higher elevation (1 400 – 1 950 m) the black pine forest (*Pinus nigra* ssp. *pallasiana*) is dominant up to the highest peak.

**Figure 3: Map of the area managed by the Department of Forests**



**Minor State Forests**

Minor State Forests are lowland forests (many of them coastal). They are found mostly in the districts of Ammochostos – most of which are now under Turkish occupation– and Larnaka. The Minor State Forests are about 8% by area of all forests. They are covered by maqui vegetation, mainly composed of *Juniperus phoenicea, Olea europaea, Ceratonia siliqua, Pistacia lentiscus, Pistacia terebinthus* and scattered *Pinus brutia.*

**Major threats**

During contemporary years, the forests worldwide are under continuous and increasing pressure, a situation that can cause serious degradation if holistic and sustainable practices are not followed. Cyprus forests are not an exception and are threatened by a variety of agents, both abiotic and biotic as well as human induced ones. Such threats are:

**Forest Fires**

Fire in Cyprus is the most catastrophic agent threatening forests and other wooded lands alike the whole Mediterranean biome. Fire hazard rises considerably during the summer period because of the climatic conditions (long, hot and dry summers and strong winds), the forest composition dominated by flammable vegetation and the topography of the forested areas, which is mostly mountainous. Moreover, urbanization increases the fire hazard because agricultural land is abandoned resulting in an increase of flammable forest vegetation and the decrease of human activity in the countryside as well as the availability of human resources in case of fires.

Several measures are being taken by the Forestry Department with the objective to eliminate forest fires. These measures include both prevention and suppression activities.

**Grazing**

It is widely accepted that overgrazing is one of the main factors causing degradation not only on the vegetation but also on the soil and water regime of the island. Grazing is effectively regulated by the forest law. However, grazing is still a serious problem in some state forest land due to inadequate enforcement of the legislation.

**Climate Change**

The last decade, forests suffer from severe prolonged drought and heat waves. More than 6 000 hectares have been affected with serious dieback and secondary insect infestations.

An action plan for the adaptation of forestry to climatic condition is under preparation.

**Other threats**

An important factor with negative impact on the existing private forests is the development of land, especially for tourism development and construction of holiday dwellings.

Unsustainable tourism development in private forest land is causing environmental damages, since a considerable number of tourists visit environmentally fragile areas rich in biodiversity. Intensive recreation in State Forest land causes degradation, soil erosion and compaction, pressure on sensitive flora and fauna species, water quantity and quality and increase of pollution. Damages from these activities have not been evaluated so far.

The major pest of forests is the pine processionary caterpillar (*Thaumetopoea wilkinsonii*), which periodically causes severe defoliation damages in coniferous forests especially in young reforestations of Calabrian pine (*Pinus brutia*).

**Forest Products and Services**

*Production and Consumption of Wood and Wood Products*

Cyprus is a net importer of all wood-based products. The overall wood market imports accounts up to 97,1%, while exports are negligible. The average annual wood consumption for the years 1992–2001 was estimated to around 174 000 $m^3$.

The main commercial value species of the Cyprus forests is *Pinus brutia*, which constitutes about 60% of the State forests and 90% of the growing stock. Although *Pinus brutia* can reach large sizes and produce good quality timber, the growth rate is low accounting only to about 1 $m^3$ per ha per year (maximum 2 $m^3$/year on the best quality sites). In addition, some areas are critically understocked, and regeneration is inadequate. Consequently, large areas are excluded from felling to allow for the growing stock to recover and obtain the desired stocking.

The annual cut, which is about 3 000 – 4 000 $m^3$, can only satisfy a small portion of the local demand for wood, thus timber-based industries are supported on imported timber, which accounts for 97,8% of their timber needs. The local yield is supplementary to some private sawmills who produce sawn-timber for constructional purposes mainly for renovation of traditional buildings, box-shooks and pallets for the export trade.

The timber-based industries of the island are gradually shrinking and there is a tendency of wood market shifting to imported final products.

The economic results of the forestry sector for 2001 were quite disappointing, whereas the annual contribution of forestry to the economy of Cyprus is negligible, being 0,026% of GDP. The share of timber-based industries is more significant, accounting for 1,1% of GDP in the same period: 0,6% for wood-working industries (sawmilling, wood-based panels, wooden pallets) and 0,5% for wooden furniture. The contribution of the furniture industry has been quite stable during the last five years, despite the growing imports of furniture. The wood consumption per capita was 0,95 $m^3$.

**Non Wood Forest Products (NWFPs) and Services**

The forests of Cyprus are an important national resource which provides not only timber but also NWFPs. Their contribution to the national product in monetary terms is difficult to be estimated because of the informal marketing of these products.

Forests provide important direct, indirect benefits and services such as protection of soil and water resources, conservation of biological diversity, carbon sink, support to agricultural productivity, picnicking, camping, hiking,

walking, cycling, skiing, bird-watching, sightseeing, hunting, fishing, carbon sequestration and mitigation of global warming, combating desertification, mushrooms, medicinal and aromatic plants, cones, acorns, resin etc.

**Importance of Forest Genetic Resources**

Forest genetic resources have significant contribution to the ecology and the economy of the island. Although only *Pinus brutia* is managed for timber production, the indirect role of forest genetic resources is of great importance for other sectors of economy (agriculture, ecotourism, water supply, employment etc.).

The high genetic variation which is present in natural forests contributes to the landscape diversity and to the conservation and development of biodiversity in the forests, whereas better adaptation to biotic and abiotic factors (fires, drought, climate change, etc.) is ensured.

The above genetic variation includes important adaptive traits to biotic and abiotic agents which are worldwide useful for selection and use.

**Changing Demands and Driving Forces in the Forestry Sector**

The last two decades, important changes have been observed in the demand for forest products and services. In the case of wood products, there is a constant increase in demand. However, the needs are covered with the importation of timber and wood products in the island. No increase in the annual cut has been approved. Similarly the demand for non wood products and services is increasing and the forestry sector has been restructured for fulfilling the demand.

The driving forces for the above changes are the low wood productivity of forests, the observed climatic changes and their effect on forests, the need for conserving biodiversity, the vulnerability and fragility of forest ecosystems, the desertification risk, the demand for sustainable use of forests and the increasing demand for recreational services.

For fulfilling the demands, there were significant amendments in the sector of forestry policy and law and the national forest program. The declaration of new protected areas (Nature Reserves, National Parks, Natura 2000 Sites etc.), the reduction in the annual timber cut and the preparation of management plans contribute to this direction too.

The existing management systems are considered sufficient for the sustainable use of forest resources in Cyprus in the near future. However, the preparation of an annual plan for the adaptation of Cyprus Forests to the climatic changes is important for reinforcing the sustainable use of the forest resources.

The large number of plant species and their high genetic variability constitute the base for the continuation of the provision of all benefits and services offered by the forests.

## C. MAIN BODY OF THE COUNTRY REPORT

## CHAPTER 1: The Current State of Forest Genetic Resources

### Diversity within and between forest tree species

The forests of Cyprus are dominated by coniferous species which form pure or mixed stands. Some deciduous tree species can be found scattered in small stands in various areas.

The main tree species are *Pinus brutia*, *Pinus nigra* ssp. *pallasiana*, *Cedrus brevifolia*, *Cupressus sempervirens*, *Juniperus phoetidissima*, *Juniperus excela*, *Platanus orientalis*, *Alnus orientalis*, *Quercus infectoria* ssp.*veneris* which are native.

*Pinus brutia* is the dominant and grows naturally almost everywhere (138 000 ha) from sea level to an elevation of 1 400 m. It forms pure and mixed stands and usually dense understory of a wide range of shrubs, accompany them. The *Pinus nigra* forest colonizes the highest peaks of Troodos range (2 640 ha pure stands) and in some places is mixed with *Juniperus phoetidissima* and/or *Pinus brutia*.

There are no deciduous forests. An exception is the riparian vegetation (1 000 ha) made up of P*latanus orientalis, Alnus orientalis,* and *Salix alba* individuals.

Maqui and phryganic ecosystems occupy a large area in Cyprus (213 000 ha) and mostly are made up of sclerophylus species such as: *Quercus alnifolia, Crataegus azarolus*, *Pistacia lentiscus, Pistacia terebinthus, Olea europaea, Ceratonia siliqua, Sarcopoterium spinosum, Thymus capitatus, Ziziphus lotus.*

Major forest types are shown on the *Table 3* below:

**Table 3: Major forest types, categories and species**

| Major Forest type | Area (covered by forest type) Year: 2007 ha | Main species for each type | |
|---|---|---|---|
| | | Trees | Other species if applicable (Accompany species) |
| Total forest | 172 853 | | |
| All conifers | 171 723 | *Pinus brutia** | *Quercus alnifolia, Arbutus andrachne, Pistacia lentiscus, Pistacia terebinthus, Rhus coriaria, Quercus coccifera* |
| | | *Pinus nigra ssp. pallasiana* | |
| | | *Pinus pinea* | |
| | | *Cedrus brevifolia* | |
| | | *Juniperus foetidissima* | |
| | | *Juniperus excelsa* | |
| | | *Juniperus phoenicea* (Shrub) | |
| | | *Cupressus sempervirens* | |
| Broadleaves | 1 130 | *Platanus orientalis* | |
| | | *Alnus orientalis* | |
| | | *Salix alba* | |
| | | *Ceratonia siliqua* | |
| | | *Olea europaea* | |
| | | *Quercus infectoria ssp. veneris* | |
| | | *Populus spp.* | |

*

| *Pinus brutia* | | Area covered by *Pinus brutia* Year: 2007 ha | Main species for each type | |
|---|---|---|---|---|
| | | | Trees | Other species if applicable |
| Productive forests | | 41 399 | *Pinus brutia* | ---------- |
| Non-productive forests | | 22 916 | | ---------- |
| Other forests (*Pinus brutia*) | ALL | 73 429 | | ---------- |
| Total Forest (*Pinus brutia*) | all | 137 744 | | ---------- |

**The Main Value of Forest Genetic Resources**

The only species which is actively managed for timber production is *Pinus brutia*, which constitutes about 60% of the State Forests and the average annual cut for the last years is only 4 000 $m^3$ (See *Table 4* below).

**Table 4: Main forest species currently used in Cyprus**

| Species (scientific names) | Native (N) or exotic (E) | Current uses (codes) | If managed, type of management system (e.g. natural forest, plantation, agroforestry) | Area managed if Known (ha) |
|---|---|---|---|---|
| *Pinus brutia* | N | Solid wood products and energy (fuel) 1, 3 | Natural/Seminatural Forest | 41 399 |

***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 (please specify)_____

Although *Pinus brutia* is the only species used for timber production, there are additional species of priority which are shown in the *Table 5* below:

**Table 5: Priority species (scientific names)**

| Priority species | | | Reasons for priority |
|---|---|---|---|
| Scientific name | Tree (T) or other (O) | Native (N) or exotic (E) | |
| *Pinus brutia* | T | *N* | Economic and ecological |
| *Pinus nigra ssp. pallasiana* | T | N | Ecological, social and cultural importance |
| *Cedrus brevifolia* | T | N | Ecological, social importance and threatened |
| *Juniperus foetidissima* | T | N | Ecological importance and threatened |
| *Juniperus excelsa* | T | N | Ecological importance and threatened |
| *Juniperus phoenicea* | O | N | Ecological, social and cultural importance and threatened |
| *Cupressus sempervirens* | T | N | Economic, ecological, social and cultural importance |
| *Quercus infectoria ssp. veneris* | T | N | Ecological, social and cultural importance and threatened |
| *Quercus alnifolia* | O | N | Ecological importance |
| *Platanus orientalis* | T | N | Ecological and cultural importance |
| *Alnus orientalis* | T | N | Ecological importance |
| *Eucalyptus spp.* | T | E | Ecological, Social |
| *Ailanthus altissima* | T | E | Invasive (priority for removal from some protected areas) |
| *Acasia saligna* | T | E | Invasive (priority for removal from some protected areas) |

The environmental and social value of the most important species shown on the following *Table 6*:

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

| Species (scientific names) | Native (N) or exotic (E) | Environmental services or social values (code) |
|---|---|---|
| *Pinus brutia* | N | 1,3,5 |
| *Pinus nigra ssp. pallasiana* | N | 1,3,4,5 |
| *Cedrus brevifolia* | N | 1,3,4,5 |
| *Juniperus foetidissima* | N | 1,3,5 |
| *Juniperus phoenicea* | N | 1,3,5 |
| *Juniperus excelsa* | N | 1,3,5 |
| *Cupressus sempervirens* | N | 1,3,4,5 |
| *Quercus infectoria ssp. veneris* | N | 1,3,4,5 |
| *Quercus alnifolia* | N | 1,3,5 |
| *Platanus orientalis* | N | 1,3,4,5 |
| *Alnus orientalis* | N | 1,3,5 |
| *Eucalyptus spp.* | E | 1,3,5 |

**Services and values include:**

1 Soil and water conservation including watershed management
2 Soil fertility
3 Biodiversity conservation
4 Cultural values
5 Aesthetic values 29
6 Religious values
7 Other (please specify) _____

Due to the various factors (geography, climate, isolation etc.) the endemism in Cyprus is high and therefore the genetic value of the endemic species is considerable. There are 143 taxa which are recorded as endemic. The *Table 7* below shows **only** the endemic *trees* and *shrubs/subshrubs* found in Cyprus:

**Table 7: Forest trees and other woody species which are endemic in Cyprus**

| FOREST TREES AND OTHER WOODY SPECIES WHICH ARE ENDEMIC IN CYPRUS | | | |
|---|---|---|---|
| 1 | *Acinos troodi* | 27 | *Onosma caespitosa* |
| 2 | *Alyssum akamasicum* | 28 | *Onosma fruticosa* |
| 3 | *Alyssum chondrogynum* | 29 | *Onosma troodi* |
| 4 | *Alyssum troodi* | 30 | *Origanum cordifolium* |
| 5 | *Anthemis plutonia* | 31 | *Origanum majorana var* |
| 6 | *Anthemis tricolor* | 32 | *Origanum syriacum ssp bevanii* |
| 7 | *Arabis cypria* | 33 | *Phlomis brevibracteata* |
| 8 | *Arabis purpurea* | 34 | *Phlomis cypria var cypria* |
| 9 | *Asperula cypria* | 35 | *Phlomis cypria var occidentalis* |
| 10 | *Astragalus echinus ssp* | 36 | *Pterocephalus multiflorus ssp* |
| 11 | *Astragalus macrocarpus ssp* | 37 | *Pterocephalus multiflorus ssp* |
| 12 | *Ballota integrifolia* | 38 | *Ptilostemon chamaepeuce var* |
| 13 | *Bosea cypria* | 39 | *Quercus alnifolia* |
| 14 | *Carlina pygmaea* | 40 | *Rosa chionistrae* |
| 15 | *Cedrus brevifolia* | 41 | *Rubia laurae* |
| 16 | *Centaurea akamantis* | 42 | *Salvia willeana* |
| 17 | *Dianthus cyprius* | 43 | *Saponaria cypria* |
| 18 | *Dianthus strictus var troodi* | 44 | *Scabiosa cyprica* |
| 19 | *Erysimum kykkoticum* | 45 | *Sideritis cypria* |
| 20 | *Genista sphacelata ssp crudelis* | 46 | *Teucrium cyprium ssp cyprium* |
| 21 | *Hedysarum cyprium* | 47 | *Teucrium cyprium ssp kyreniae* |
| 22 | *Helianthemum obtusifolium* | 48 | *Teucrium divaricatum ssp* |
| 23 | *Micrimeria cypria* | 49 | *Teucrium micropodioides* |
| 24 | *Micromeria chionistrae* | 50 | *Thlaspi cyprium* |
| 25 | *Nepeta troodi* | 51 | *Thymus integer* |
| 26 | *Odontites cypria* | | |

As regards the forest reproductive material, *Tables 8* and *9* shows relevant data:

**Table 8: Annual quantity of seeds produced and current state of identification of forest reproductive material of the main forest tree and other woody species in Cyprus.**

| Species | | Total quantity of seeds used (Kg) | Quantity of seeds from documented sources (provenance/ delimited seed zones) | Quantity of seeds from tested provenances (provenance trials established and evaluated) | Quantity that is genetically improved (from seed orchards) |
|---|---|---|---|---|---|
| Scientific names | Native (N) or exotic (E) | | | | |
| *Pinus brutia* | N | 500 | provenance | …… | …… |
| *Pinus nigra ssp. pallasiana* | N | 5 | provenance | …… | …… |
| *Cedrus brevifolia* | N | 6 | provenance | …… | …… |
| *Cupressus sempervirens* | N | 58 | delimited seed zones | …… | …… |
| *Juniperus excelsa* | N | 5 | delimited seed zones | …… | …… |
| *Juniperus foetidissima* | N | 5 | provenance | …… | …… |
| *Quercus infectoria ssp. veneris* | N | 16 | delimited seed zones | …… | …… |
| *Quercus alnifolia* | N | 13 | delimited seed zones | …… | …… |
| *Juniperus phoenicea* | N | 5 | provenance | …… | …… |

**Table 9: Annual number of seedlings (or vegetative propagules) planted in the state of identification of forest reproductive material of the main forest tree and other woody species in Cyprus.**

| Species | | Total quantity of seedlings planted | Quantity of seedlings from documented sources (provenance/ delimited seed zones) | Quantity of seedlings from tested provenances (provenance trials established and evaluated) | Quantity of vegetative reproductive material used | Quantity of seedlings that are genetically improved |
|---|---|---|---|---|---|---|
| Scientific names | Native (N) or exotic (E) | | | | | |
| *Pinus brutia* | N | 45 000 | provenance | …… | …… | …… |
| *Pinus nigra ssp. pallasiana* | N | 1 000 | provenance | …… | …… | …… |
| *Cedrus brevifolia* | N | 4 500 | provenance | …… | …… | …… |
| *Cupressus sempervirens* | N | 30 000 | delimited seed zones | …… | …… | …… |
| *Juniperus excelsa* | N | 700 | delimited seed zones | …… | …… | …… |
| *Juniperus foetidissima* | N | 1 000 | provenance | …… | …… | …… |
| *Juniperus phoenicea* | N | 5 500 | delimited seed zones | …… | …… | …… |
| *Quercus infectoria ssp. veneris* | N | 4 000 | delimited seed zones | …… | …… | …… |
| *Quercus alnifolia* | N | 2 500 | delimited seed zones | …… | …… | …… |
| *Quercus coccifera* | N | 1 000 | delimited seed zones | …… | …… | …… |

Intraspecific variation has been studied only for some tree species and has been found to be large in all species. Antecedent studies and the methods employed are shown on the Table 10. Their evaluation has been done only once and therefore there is no indication as regards the trend of the genetic variability (Increasing, decreasing, same).

The assessment of intraspecific variation for these species was carried out during graduate and post graduate studies on voluntary basis. There is no initiative for further assessments due to the lack of a national forestry research institute or a forestry school in the island. However, for enhancing further assessments and monitoring of interspesific and intraspecific variations, it is necessary to develop collaborations with research institutions abroad and/or participation in research programs.

**Table 10: Antecedent studies and the methods employed on Intraspecific variation in Cyprus Forests**

| Species | Name of Study | Native (N) or Exotic (E) | Methods and Characters assessed | | | |
|---|---|---|---|---|---|---|
| | | | Method of Study | Morphological traits | Adaptive and production characters assessed | Molecular Characterization |
| *Cedrus brevifolia* | The genetic and taxonomic status of Cyprus cedar, *Cedrus brevifolia* (Hook) Henry. [MSc Thesis, MAICh, Chania, Greta, Greece]. | N | Isozyme and Morphological traits | √ | | |
| *Cedrus brevifolia* | First analysis on allozyme variation in Cedar species (*Cedrus* sp.) [Silvae Genet, 41: 339–342] | N | Isozyme | | | |
| *Cedrus brevifolia* | Allozyme differentiation and phylogeny of cedar species. [Silvae Genet, 48: 61–68] | N | Isozyme | | | |
| *Cedrus brevifolia* | Karyotype analysis reveals interspecific differentiation in the genus *Cedrus* despite genome size and base composition constancy. [Theor Appl Genet, 103: 846–854] | N | karyotype analysis | | | |
| *Cedrus brevifolia* | Geographical diversity and genetic relationships among *Cedrus* species estimated by AFLP. [Tree Gen. & Genomes, 3: 275–285] | N | Molecular markers | | | √ |
| *Cedrus brevifolia* | Isozyme gene markers and taxonomy of Mediterrannean *Cedrus* species. [Proceedings of the final conference of the EU project FAIR CT95-0097. Aristotle University of Thessaloniki, Mytilene, 21–26] | N | Isozyme | | | |
| *Cedrus brevifolia* | Gene flow among different taxonomic units: evidence from nuclear and cytoplasmic markers in *Cedrus* plantation forests. [Theor Appl Genet, 107, 1132–1138] | N | Molecular markers | | | √ |
| *Cedrus brevifolia* | Fingerprinting of genetic diversity and patterns of spatial genetic variation in the endemic tree *Cedrus brevifolia* (Hook f.) Henry from Cyprus: implications for its conservation. [PhD thesis, Georg-August University Goettingen, Germnay. Optimus, Goettingen] | N | Molecular markers | | | √ |
| *Cedrus brevifolia* | High genetic diversity and significant population structure in *Cedrus brevifolia* Henry, a narrow endemic Mediterranean tree from Cyprus.[Plants Syst. and Evol. 294: 185-198] | N | Molecular markers | | | √ |
| *Quercus alnifolia* | Allozyme characterisation of four Mediterranean evergreen oak species. [Biochem Syst and Ecol, 29: 799–817] | N | Isozyme | | | |
| *Quercus alnifolia* | Description of genetic variety of natural populations of the Cyprus endemic plant *Quercus alnifolia* Poech in accordance with morphological characteristics. [BSc Thesis, Demokritus University of Thrace, Department of Forestry and Management of the Environmental and Natural Resources] | N | Morphological traits | √ | | |
| *Quercus alnifolia & Q. coccifera* | Neophytou C, Dounavi A, Fink S, Aravanopoulos F (2010): Interfertile oaks in an island environment: I. High nuclear genetic differentiation and high degree of chloroplast DNA sharing between *Q. alnifolia* and *Q. coccifera in Cyprus.* A multipopulation study. Eur J Forest Res (2011) 130:543-555. DOI10.1007/s10342-010-0442-8 | N | Molecular markers | | | √ |
| *Quercus alnifolia & Q. coccifera* | Morphological differentiation and hybridization between *Quercus alnifolia* Poech and Quercus *coccifera* L Fagaceae in Cyprus. [Gen Silvae, 56: 271-277] | N | Morphological traits | √ | | |
| *Quercus alnifolia & Q. coccifera* | Interfertile oaks in an island environment. II. Limited hybridization between *Quercus alnifolia* Poech and *Q. coccifera* L. in a mixed stand. [Eur J Forest Res, 130: 543-555] | N | Molecular markers | | | √ |
| *Quercus infectoria ssp. veneris* | Conservation of Nuclear SSR Loci Reveals High Affinity of *Quercus infectoria* ssp. *veneris* A. Kern (Fagaceae) to Section Robur [Plant Mol Biol Rep, 26:133–141] | N | Molecular markers | | | √ |
| *Pinus brutia* | Research on Genetic Variation of *Pinus brutia* in Cyprus (PhD thesis, Aristotle University of Thessaloniki) | N | Isozyme & Morphological traits | √ | | |
| *Platanus orientalis* | Divergence of the natural population of Oriental plane in Cyprus. [BSc Thesis Aristotle University of Thessaloniki] | N | Morphological traits | √ | | |
| *Arabis kennedyae* | An integrated approach for the conservation of threatened plants: The case of *Arabis kennedyae* (Brassicaceae). [Acta Oecol, 37: 239-248] | N | Molecular markers | | | √ |

**Factors Affecting the State of Forest Genetic Diversity**

The importance of the main forest tree species remain the same the last years. However, a significant reduction of the annual cut of *Pinus brutia* (timber production) has been observed due to ecological demands/considerations.

From genetic consideration point of view, five main forest tree species are considered threatened. These species and other relevant information are given in the following *Table 11*:

**Table 11: Main 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 names) | *Area (ha) of species, natural distribution in your country if known | Average number of tree 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) | Threat category*** | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | High | Medium | Low |
| *Cedrus brevifolia* | 367 | 75 | 100 | L | 11,12,13 | | X | |
| *Juniperus excelsa* | 643 | 32 | n.a. | L | 12,13 | | X | |
| *Juniperus foetidissima* | 72,7 | n.a. | n.a. | L | 13 | | X | |
| *Pinus nigra ssp.. pallasiana* | 4 970 | n.a. | n.a. | L | 1,11 | | X | |
| *Quercus infectoria ssp. veneris* | 354,7**** | n.a. | n.a. | W | 5,7,11,12,13 | X | | |
| *Cupressus sempervirens* | 450***** | n.a. | n.a. | W | 5,6,7,11,12,13 | | | X |
| *Celtis tournefortii* | 8 | 60 | n.a. | R | 5,6,7 | X | | |
| *Arbutus unedo* | 1,5 | 53 | n.a. | L | 12,13,15 | X | | |
| *Phillyrea latifolia* | 596 | 8,4 | n.a. | R | 12,13 | X | | |
| *Viburnum tinus ssp. tinus* | 17 | 60 | n.a. | L | 12,13 | X | | |

**Type of threat:**

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

*Refer to species range maps where they exist to estimate the area in hectares of the species' natural range that is within the borders of your country.
**Considering the full extent of the species' natural range, which proportion is within the borders of your country? For example, an endemic species is 100% within your country. A species that is naturally distributed over approximately equal areas of your country and a neighbouring country is 50%.
***Threat categories: High – threatened throughout species range within the country; Medium – threatened in at least 50% of range within country; Low – threatened in less than 50 % of range within country.
****The given area has been declared as Natura 2000. No data for the rest of its natural distribution.
*****the given area does not include areas which are not under the effective control of the Government of the Republic of Cyprus.

The above species are locally distributed and are threatened at species level within Cyprus. The threats are given on the column "Type of Threats" and it seems that *drought, desertification, forest fires, pest and diseases, competition for land use and habitat fragmentation* are the main factors for the degradation of their genetic variation.

In addition to the above information, an assessment of the status of threatened plant species has been carried out in 2006. The assessment was based on IUCN criteria and the results are presented on *Table 12* below which shows only the trees, shrubs and subshrubs. Herbs are not included in this report.

**Table 12: List of threatened plants (Trees, shrubs and subshrubs only) in Cyprus according to IUCN criteria**

| Latin name | Life form | IUCN category | Criterion A | Criterion B | Criterion C | Criterion D1 | Criterion D2 | Year of Assessment |
|---|---|---|---|---|---|---|---|---|
| *Achillea cretica* | Shrub | VU | | | | | D2 | 2006 |
| *Achillea maritima ssp. maritima* | Subshrub | VU | A4c | | | | | 2006 |
| *Achillea santolinoides ssp. wilhelmsii* | Subshrub | CR | | B1ab(i-v)+2ab(i-v) | | | | 2006 |
| *Alyssum akamasicum* | Subshrub/perennial herb | VU | | | | | D2 | 2006 |
| *Arbutus unedo* | Shrub | CR | | B1ab(iii,v)+2ab(iii,v) | C2a(i) | | | 2006 |
| *Argyrolobium uniflorum* | Subshrub/perennial herb | CR | | B1ab(iii,v)+2ab(iii,v) | | | | 2006 |
| *Astragalus echinus var. chionistrae* | Subshrub | VU | | | | | D2 | 2006 |
| *Brassica hilarionis* | Subshrub | EN | | B1ab(iii,v)+2ab(iii,v) | C2a(i) | | | 2006 |
| *Cedrus brevifolia* | Tree | VU | | | | | D2 | 2006 |
| *Celtis tournefortii* | Shrub/tree | EN | | | C2a(i) | | | 2006 |
| *Centaurea akamantis* | Subshrub | EN | | B1ab(iii)+2ab(iii) | | | | 2006 |
| *Cionura erecta* | Shrub/subshrub | RE | | | | | | 2006 |
| *Coronilla emerus ssp. emeroides* | Shrub | CR | | | | D1 | | 2006 |
| *Ephedra nebrodensis* | Shrub | VU | | | | | D2 | 2006 |
| *Erica manipuliflora* | Shrub | VU | | | | | D2 | 2006 |
| *Erysimum kykkoticum* | Subshrub | VU | | | | D1 | D2 | 2006 |
| *Euphorbia hierosolymitana* | Shrub | VU | | | | | D2 | 2006 |
| *Euphorbia paralias* | Subshrub | EN | A4ac | | | | | 2006 |
| *Euphorbia thompsonii* | Subshrub | VU | | | | | D2 | 2006 |
| *Hedera helix ssp. poetarum* | Shrub | EN | | | | D1 | | 2006 |
| *Hedysarum cyprium* | Subshrub | VU | | B1ab(iii,v)+2ab(iii,v) | | | | 2006 |
| *Hypericum hircinum* | Shrub | VU | | | | | D2 | 2006 |
| *Lotus cytisoides* | Subshrub | EN | | B1ab(iii,v)+2ab(iii,v) | | | | 2006 |
| *Micromeria cristata ssp. cristata* | Subshrub | EN | | B1ab(ii,iv,v)+2ab(ii,iv,v) | | | | 2006 |
| *Onosma caespitosa* | Subshrub | VU | | | | D1 | D2 | 2006 |
| *Onosma orientalis* | Subshrub | VU | | | | | D2 | 2006 |
| *Onosma troodi* | Subshrub | VU | | | | | D2 | 2006 |
| *Origanum cordifolium* | Subshrub | VU | | | | | D2 | 2006 |
| *Origanum laevigatum* | Subshrub | RE? | | | | | | 2006 |
| *Osyris alba* | Shrub | VU | | | | | D2 | 2006 |
| *Phillyrea latifolia* | Shrub | VU | | | | | D2 | 2006 |
| *Phlomis brevibracteata* | Shrub | VU | | | C2a(i) | | | 2006 |
| *Phlomis cypria ssp. cypria* | Shrub | VU | | | | D1 | D2 | 2006 |
| *Phlomis cypria ssp. occidentalis* | Shrub | VU | | B1ab(iii,v)+2ab(iii,v) | | | | 2006 |
| *Phlomis longifolia var. bailanica* | Shrub/subshrub | RE | | | | | | 2006 |
| *Salvia dominica* | Shrub/subshrub | VU | | | | D1 | D2 | 2006 |
| *Satureja thymbra* | Shrub | EN | | B1ab(iii,v)+2ab(iii,v) | | | | 2006 |
| *Sideritis cypria* | Subshrub | EN | | | | D1 | | 2006 |
| *Tamarix hampeana* | Shrub/tree | EN | | | | D1 | | 2006 |
| *Viburnum tinus ssp. tinus* | Shrub | VU | | | | D1 | D2 | 2006 |
| *Hirtellina lobelii* | Subshrub | DD | | | | | | 2006 |
| *Origanum syriacum* | Shrub/subshrub | DD | | | | | | 2006 |
| *Phlomis fruticosa* | Shrub | DD | | | | | | 2006 |
| *Juniperus excelsa* | Tree/shrub | NT | | | | | | 2006 |
| *Teucrium cyprium ssp. kyreniae* | Subshrub | LC | | | | | | 2006 |

| Explanatory | |
|---|---|
| **RE:** Regionally Extinct | **DD:** Data Deficient |
| **CR:** Critically Endangered | **NT:** Near Threatened |
| **EN:** Endangered | **LC:** Least Concern |
| **VU:** Vulnerable | |

Three main forest tree species (*Juniperus foetidissima, Pinus nigra ssp. pallasiana* and *Quercus infectoria ssp. veneris)* are not included in *Table 12*; however their genetic recourses and variability are threatened as described on *Table 11*.

The above assessment (IUCN criteria) will be repeated periodically in order to have a follow up of the status and to re-plan conservation measures.

For preventing and correcting genetic erosion and vulnerability of forest genetic resources, *Ex-Situ* and *In-Situ* measures are taken. Such measures are the fire protection, use of suitable provenances, establishment of *Ex-Situ* plantations, genetic pollution consideration when establishing exotic species etc. "*National Forest Law"*, "*Forest Policy*" and "*Policy on Nurseries*, *Afforestation and Reforestation*" include provisions for protecting forest genetic resources. Such provisions are the declaration of protected areas, national forest parks, provisions on fires, pests and grazing, use and characterization of forest reproductive material etc.

Although there is concern on forest genetic resources, there is no risk disaster analysis prepared. However, after a disaster i.e. fire, the reestablishment of forest ecosystem is considerably based on principles promoting the pre-existing forest genetic resources and their characteristics (broad genetic base).

For improving further the *forest genetic resources disaster response mechanism*, the country should study in depth the seeding frequency of the main forest species and to develop sufficient (quality and quantity) stock of forest reproductive material (seeds/plants). Furthermore, erosion and vulnerability should be assessed by introducing advanced research techniques i.e. P.C.R. analysis.

**Future Needs and Priorities**

Although there is some research on the diversity of forest genetic resources, additional research is necessary to be applied for a number of forest species. Priority should be placed on the investigation of adaptation traits which are important for the quick response to factors threaten the forestry, such as climatic changes, fires and desertification in the area of Mediterranean. Conservation of the intra-specific variation is a priority as well. However, the lack of a national forest research institute and/or forest university school is a weakness which inhibits the enhancement of the research of the above genetic parameters. Collaboration with such institutions abroad should be promoted.

Ecological value of the forest genetic resources is much important for the island since timber production is of minor value and the forests are predominantly managed for their ecological value and their indirect benefits. The importance of forests is generally well understood by the public; however the specific value of forest genetic resources is only well understood within the community of foresters and ecologists. The two groups put effort to the direction of conservation and management of forest genetic resources, needing however more scientific approach.

Surveys and inventories of national forests are well organized within the Department of Forests. However, these surveys do not include genetic parameters and information (intra-specific variation, adaptation traits etc). Additionally, national and regional intervention would further contribute positively to the effective conservation and management of forest genetic resources.

## CHAPTER 2: The State of *In-Situ* Genetic Conservation

Because of the vulnerability and fragility of forest ecosystems in the island, most of them have been put under conservation programs.

Inventories and surveys are carried out for a number of plant species, mostly for conservation and management purposes and not exclusively for *In-Situ* genetic conservation purposes. Such species are *Pinus brutia, Pinus nigra ssp. pallasiana, Cupressus sempervirens, Cedrus brevifolia, Juniperus excelsa, Juniperus foetidissima, Quercus infectoria ssp. veneris, Quercus alnifolia, Juniperus phoenicea, Platanus orientalis, Alnus orientalis* etc. Additionally, surveys and monitoring are carried out for species included in EC Habitats Directive (Council Directive 92/43/EEC), Natura 2000, which are mainly shrubs and herbs.

In addition to the inventories and surveys, for a number of species, specific *In-Situ* conservation actions have been taken, mainly for the conservation of the ecosystems. Details are shown on the following Table 13.

**Table 13: *In-Situ* conservation measures for conserving ecosystems and species**

| | Species | *In-Situ* Conservation Category (Managed Production Forests, Provenance Zone, Strictly Protected Zone, Natura 2000, Nature Reserves, National Parks, Micro reserve | Purpose of Establishing Conservation Unit | Number of Populations or Stands Conserved | *In-Situ* Conservation Actions (Management plans, Fire protection, Natural regeneration promotion, Monitoring, No fellings, Fencing, Regeneration enrichment, Surveys and Inventories). | Total Area (ha) | Remarks |
|---|---|---|---|---|---|---|---|
| 1 | *Cedrus brevifolia* | Natura 2000, Micro reserve Nature Reserve | Protection and conservation of Cedar's ecosystem. | 1 | Fire protection, no fellings, management plan, inventory | 367 | |
| 2 | *Pinus nigra ssp. pallasiana* | Natura 2000 National Park | Protection and conservation of *Pinus nigra* ecosystem. | 1 | Fire protection, no fellings, survey, natural regen. promotion, regeneration enrichment | 4 970 | |
| 3 | *Juniperus foetidissima* | Natura 2000 National Park | Protection and conservation of *Juniperus foetidissima* ecosystem. | 1 | Fire protection, no fellings, survey natural regen. promotion, regeneration enrichment | 72,7 | |
| 4 | *Juniperus excelsa* | Natura 2000 | Protection and conservation of *Juniperus excelsa* ecosystem. | 1 | Fire protection, no fellings, survey natural regen. promotion, regeneration enrichment | 643 | |
| 5 | *Quercus infectoria ssp. veneris* | Natura 2000 | Protection and conservation of *Quercus infectoria ssp. veneris* small stands | A number of small stands | Fire protection, no fellings, monitoring, natural regen. promotion, regeneration enrichment | 354,7 | |
| 6 | *Cupressus sempervirens* | Natura 2000 | Protection and conservation of *Cupressus sempervirens* | A number of small stands | Fire protection, no fellings, monitoring | 300 | |
| | *Quercus alnifolia* | Natura 2000 Micro reserve National Park | Protection and conservation of *Quercus alnifolia* | A number of populations | Fire protection, no fellings, natural regen. promotion, regeneration enrichment, monitoring | n.a | |
| 7 | *Celtis tournefortii* | ---------- | Protection and conservation of *Celtis tournefortii* | A number of small stands | Monitoring | 8 | |
| 8 | *Arbutus unedo* | Natura 2000 | Protection and conservation of *Arbutus unedo* | 1 | Fire protection, monitoring, fencing | 1,5 | |
| 9 | *Phillyrea latifolia* | Natura 2000 | Protection and conservation of *Phillyrea latifolia* | 2 | Fire protection, monitoring | 75 | |
| 10 | *Arabis kennedyae* | Natura 2000, Micro-reserve, Nature Reserve | Protection and conservation of *Arabis kennedyae* | 3 | Monitoring | n.a | |
| 11 | *Astragalus macrocarpus ssp. lefkarensis* | Natura 2000 Micro-reserve, | Protection and conservation of *Astragalus macrocarpus ssp. lefkarensis* | 2 | Monitoring, planting, irrigation | n.a | |
| 12 | *Centaurea akamantis* | Natura 2000 Micro-reserve | Protection and conservation of *Centaurea akamantis* | 2 | Fire protection, monitoring, planting, fencing | 2,3 | |
| 13 | *Chionodoxa lochiae* | Natura 2000 National Park | Protection and conservation of *Celtis tournefortii* | 9 | Fire protection, monitoring | 80 | |
| 14 | *Crepis pusilla* | Natura 2000 | Protection and conservation of the ecosystem | 2 | Monitoring | n.a | |
| 15 | *Crocus cyprius* | Natura 2000 National Park | Protection and conservation of the ecosystem | 3 | Monitoring | n.a | |
| 16 | *Crocus hartmannianus* | Natura 2000 National Park | Protection and conservation of the ecosystem | 5 | Monitoring | n.a | |
| 17 | *Ophrys kotschyi* | Natura 2000 Micro-reserve | Protection and conservation of *Ophrys kotschyi* | 5 | Monitoring, artificial pollination | n.a | |
| 18 | *Phlomis brevibracteata* | Natura 2000 | Protection and conservation of the ecosystem | 3 | Fire protection, monitoring | n.a | |
| 19 | *Phlomis cypria ssp. occidentalis* | Natura 2000 | Protection and conservation of the ecosystem | 7 | Fire protection, monitoring | n.a | |
| 20 | *Pinguicula crystallina* | Natura 2000 National Park | Protection and conservation of the ecosystem | 8 | Fire protection, monitoring | 1 | |
| 21 | *Ranunculus kykkoensis* | Natura 2000 | Protection and conservation of the ecosystem | 4 | Fire protection, monitoring | n.a | |
| 22 | *Scilla morrisii* | Natura 2000 | Protection and conservation of the ecosystem | 3 | Monitoring | n.a | |
| 23 | *Tulipa cypria* | Natura 2000 | Protection and conservation of the ecosystem | 1 | Monitoring | 6,5 | |

For further improvement of *In-Situ* conservation, it is necessary to have a concrete conservation programme for all species involved and an evaluation procedure for the genetic conservation actions should be established. Until today, there is a number of efforts for the conservation of the genetic resources; however these efforts are not well documented and monitored. The above weakness is due to the lack of adequate personnel and financial resources, inadequate knowledge, and the competing use for available land. Additionally, there are vulnerable forest species which are found in areas not being under the effective control of the Government of the Republic of Cyprus and therefore their conservation is inhibited.

For the future *In-Situ* conservation actions, priorities are the conservation of species included in the Red Data Book, species with small population and the establishment of a concrete conservation action plan.

The achievement of the above prerequisites training of personnel, establishment of a national/regional forum for stakeholders involved with *In-Situ* conservation and further research capacity-building to support *In-Situ* conservation, including analysis for genetic conservation evaluations.

## CHAPTER 3: The State of *Ex-Situ* Genetic Conservation

*Ex-Situ* conservation for forest tree species is applied only for a small number of species. Only recently, decision has been taken for widening the *Ex-Situ* genetic conservation program.

Details for existing *Ex-Situ* conservation measures are shown on the Tables 14 &15.

**Table 14: *Ex-Situ* conservation**

| Species | | Field collection | | | | Seed bank | | | |
|---|---|---|---|---|---|---|---|---|---|
| Scientific names | Native (N) or exotic (E) | Collections, provenance or progeny test, arboreta or conservation stands | | Clone banks | | In vitro (including cryo conservation) | | Seed banks | |
| | | No. stands and size | No.acc. (No. of families and total plants) | No. stands and size ha | No.acc. (No. of families and total plants) | No banks | No.acc. | No banks | No.acc. (No. of seeds, bulk or single plant) |
| *Juniperus excelsa* | N | Stands 1 (0,5 ha) | Families 59 Plants 265 | ------- | ------- | ------- | ------- | ------- | ------- |
| *Cedrus brevifolia* | N | Stands 3* (4,0 ha) | Families 129 Plants 603 | ------- | ------- | ------- | ------- | 1 | 6 |
| *Pinus brutia* | N | ------- | ------- | Stands 2 (16 ha) | Families 100 Plants 800 | ------- | ------- | 1 | 1 |
| *Arabis kennedyae* | N | ------- | ------- | ------- | ------- | ------- | ------- | 1 | 3 |
| *Astragalus macrocarpus ssp. lefkarensis* | N | ------- | ------- | ------- | ------- | ------- | ------- | 2 | 15 |
| *Brassica hilarionis* | N | ------- | ------- | ------- | ------- | ------- | ------- | 3 | 6 |
| *Centaurea akamantis* | N | ------- | ------- | ------- | ------- | ------- | ------- | 2 | 7 |
| *Chionodoxa lochiae* | N | ------- | ------- | ------- | ------- | ------- | ------- | 1 | 2 |
| *Phlomis brevibracteata* | N | ------- | ------- | ------- | ------- | ------- | ------- | 2 | 7 |
| *Phlomis cypria ssp. Cypria* | N | ------- | ------- | ------- | ------- | ------- | ------- | 2 | 5 |
| *Phlomis cypria ssp. occidentalis* | N | ------- | ------- | ------- | ------- | ------- | ------- | 2 | 7 |
| *Pinguicula crystallina* | N | ------- | ------- | ------- | ------- | ------- | ------- | 1 | 4 |
| *Ranunculus kykkoensis* | N | ------- | ------- | ------- | ------- | ------- | ------- | 1 | 3 |
| Salvia veneris | N | ------- | ------- | ------- | ------- | ------- | ------- | 3 | 5 |
| *Scilla morrisii* | N | ------- | ------- | ------- | ------- | ------- | ------- | 3 | 6 |
| *Sideritis cypria* | N | ------- | ------- | ------- | ------- | ------- | ------- | 2 | 3 |
| *Tulipa cypria* | N | ------- | ------- | ------- | ------- | ------- | ------- | 3 | 3 |

* Unavailable data for one of the stands

**Table 15: Botanical Gardens**

| | Name of Botanical Garden | Size ha | Year of Establishments | *Purpose of Establishments* |
|---|---|---|---|---|
| 1 | Athalassa A' | 1,7 | 1964 | Establishment of exotic trees and shrubs for scientific, educational and seed production purposes |
| 2 | Athalassa B' | 1,6 | 1994 | Establishment of indigenous and endemic plants for scientific, educational, seed production and conservation purposes |
| 3 | Loutra tis Aphroditis | 2,0 | 2006 | Establishment of indigenous and endemic plants for scientific, conservation ,educational and seed production purposes |
| 4 | Troodos, Anastasios Leventis | 0,5 | 2010 | Establishment of indigenous and endemic plants for scientific, conservation, educational and seed production purposes |

Infrastructure capacity for *Ex-Situ* conservation includes two seed banks with laboratories which cover agricultural and wild plants. These banks are accommodated at the "*Agricultural Research Institute*" and the private "*Frederick University*". Seeds are collected by officers of the "*Agricultural Research Institute*", the Department of Forests and other researches who are well aware about plant taxonomy and conservation. Approved protocols are applied for the collection, storage, documentation and characterization of the seed.

A third seed bank is under consideration and is going to cover specifically the forestry demands.

*Ex-Situ* genetic conservation is currently promoted through the further training of the involved officers, the inclusion of new species for conservation, the research and the decision for establishing an additional seed bank to cover the forestry needs. However, deficiency in financial resources and personnel and the lack of a concrete *Ex-Situ* conservation program are the limiting factors for the full achievement of the *Ex-Situ* conservation activities.

Priorities for the future *Ex-Situ* actions are the establishment of a concrete *Ex-Situ* conservation program, the establishment of a new seed bank and the further collaboration of the national, international and regional organizations dealing with conservation aspects.

## CHAPTER 4: The State of Use and Sustainable Management of Forest Genetic Resources

The main commercial value species of Cyprus forests is *Pinus brutia* which constitutes about 90% of the growing stock. However, due to the climatic condition, its growth is very low and consequently the yield can satisfy only a small portion of the local demand for wood (annual cut 4 000 $m^3$). For this reason, forests in Cyprus are managed mainly for providing indirect benefits and services such as protection of soil and water resources, conservation of biological diversity, support to agricultural productivity, recreation, carbon sequestration and mitigation of global warming, combating desertification, mushrooms, medical and aromatic plants etc.

Considering the above management objectives, conservation strategies aim to the protection of forests ecosystems and species individually. This is the reason why tree improvement programs for wood production are not important for Cyprus Forestry while protection and conservation of ecosystems and biodiversity are much important.

Table 16 shows *Pinus brutia* as the only species used in the tree improvement program.

**Table 16: Forest Improvement program**

| Species | | Improvement programme objective | | | | | |
|---|---|---|---|---|---|---|---|
| Scientific names | Native (N) or exotic (E) | Timber | Pulpwood | Energy | MP* | NWFP** | Other |
| *Pinus brutia* | N | √ | ------- | ------- | ------- | ------- | ------- |

*multipurpose tree programs, ** Non-wood forest products

As regards the movement of forest reproductive material internationally, no commercial imports and exports are done and only at national level there is movement to cover local needs. Small quantities of seeds are moved internationally for scientific purposes.

*Pinus brutia* is the only species for which seed and clonal orchards have been established in the past. These orchards are maintained and there is no collection of reproductive material and no testing has been applied since nowadays timber production is not a priority. Great concern is given to the use of appropriate provenances and promotion of natural regeneration in afforestation/reforestation programs.
The Tables 17 and 18 below show information regarding the orchards.

**Table 17: Tree Improvement Trial**

| Species | | Plus trees | Provenance trials | | Provenance trials | | Clonal testing and development | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Scientific names | Native (N) or exotic (E) | Number | No of trials | No. of prov. | No of trials | No of families | No of tests | No of clones tested | No clones selected | No of clones used |
| *Pinus brutia* | N | 174 | ------- | ------- | ------- | ------- | ------- | ------- | ------- | ------- |

**Table 18: Seed Orchards**

| Species (Scientific names) | Seed orchard | | |
|---|---|---|---|
| | Number | Generation | Area ha |
| *Pinus brutia* | 3 | 1st | 19 |

Until now, there is no any action or participatory tree breeding program in Cyprus. However, the necessity for such an action/program is great and should focus on the species improvement for adaptation to the climatic changes (i.e. drought).

**Availability of Reproductive Material**

Reproductive material (only seeds) can be made available only at request and only for the good seed years. The forest reproductive material is not improved but can be separated in provenances or place of origin.

## CHAPTER 5: The state of National Program, Research, Education, Training and Legislation

### National Program

National Forest Program is prepared and revised every ten years. Although there are provisions in the program related with forest genetic resources, these provisions are rather general and not specific including general measures for conserving forests ecosystems.

The small scale engagement in conservation and sustainable use of forest genetic resources is carried out by governmental institutions which are show on the Table 19 below.

**Table 19: Institutions involved with conservation and use of forest genetic resources**

| Name of Institution | Type of Institution | Activities of Programs | Contact Information |
|---|---|---|---|
| Department of Forests | Governmental | Management, conservation and use of State Forests | achristou@fd.moa.gov.cy Tel: +357 22819490 |
| Agricultural Research Institute | Governmental | Running the Seed Bank (CYARI) | A.kyratzis@arinet.ari.gov.cy |
| Nature Conservation Unit of the Frederick University | Private University | Research projects focusing on nature conservation. Running seed bank (NCU) | pre.kc@fit.ac.cy |

The Department of Forests is the national Institution which is more actively involved in the conservation and use of forest genetic resources. Although there is some collaboration among different institutions, there is no coordination or specific national program for forest genetic resources.

The trends in supporting forest genetic resources have been became stronger the last 10 years. The budget is slighting increasing for this purpose.

### Research, Education and Training

The *national research* for forest genetic resources is very poor and only a very small proportion of the forestry budget goes to forest genetic resources. This is due to the lack of a national research institute or university school dealing with forestry. The small scale research is carried, from time to time, by forestry schools and institutes abroad or in the frame of small projects.

National education and training on forest genetic resources is covered at Diploma level at the Cyprus Forestry College (technical level) in the course “Forest Genetics”. Additionally, at scientific level, the subject is cover at Bsc, Msc and PhD at Universities abroad, from where many Cypriots graduate and afterwards work in Cyprus.

Training and research are priorities for Cyprus. Training is necessary for a group of people dealing in the management of forests and should focus on the methods of conserving forest genetic resources while research should focus on the conservation of the most important forest species and identification of traits related to the adaptation to abiotic factors (i.e. climate change, drought etc)

### National legislation

There is a number of legislative or policy provisions relevant to forest genetic resources. The provisions are rather general and the objective is mainly the conservation and protection of the national forests and into a smaller scale, the national forest genetic resources. These provisions are included under the:

- The Forest Law and Regulations (Consolidated all amendments until 2010 – Department of Forests),
- A Statement of Forest Policy (Department of Forests),
- Policy on the Production and Establishment of Forest Plants (Department of Forests),
- Law for Protection and Management of Nature and Wildlife (Law 153 (1), 2003),
- Phytosanitary law (on protective measures against the introduction of organisms harmful to plants or plant products and against their spread, Low 2003 and 2005)
- Regulation on Forest Reproductive Material (Law 1991 - 2002).

Although there are provisions, no legal framework for forest genetic resources strategies, plans and programs are established.

A number of conventions have been endorsed by Cyprus and they are related to forest genetic resources and management. These conventions are:

- UNCCD " United Nations Convention to Compact Desertification"
- Convention for the Biological Diversity (CBD)
- RAMSAR Convention
- CITES Convention
- BERN Convention
- International Treaty on plant Genetic Resources for food and Agriculture (ITPGRFA)

Table 20 below shows the identified needs for strengthening forest genetic resources legislation.

**Table 20: Needs for developing forest genetic resources legislation**

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

**Public Awareness**

There is no specific public awareness program for forest genetic resources in Cyprus. This is probably due to the state of ownership of the managed forests which are Public and State forests. However, there is satisfactory public awareness program for the importance of national forest ecosystems and resources.

The priorities for raising public awareness for forest genetic resources issues are shown on the following Table 21.

**Table 21: Awareness raising needs**

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

## CHAPTER 6: The state of Regional and International Agreement and Collaboration

### International Agreements

As has been mention on CHAPTER 6, Cyprus has signed a number of conventions with regard to the conservation and sustainable use of forest genetic resources (CBD, UNCCD, RAMSAR, CITES, BERN).

United Nations Conservation to Compact Desertification (UNCCD) contributed to the preparation of the national plan for competing desertification while all other conventions further support national measures for conserving biodiversity and sustainability.

### International Collaboration

As regards to the International Collaboration, Cyprus participated in the European Forest Genetic Resources Program (EUFORGEN), Phase II and III for the period 2002 – 2010. During that period, important knowledge has been obtained as regard genetic conservation and use of forest genetic resources in the region of Europe.

Table 22 below shows relevant information.

**Table 22: Overview of the main activities carried out through network and their output**

| Network name | Activities (at national level) | Genus/species involved (important at national level |
|---|---|---|
| EUFORGEN (Phase II and III) | Information exchanges, Development of technical guidelines, Development of shared databases | *Pinus brutia* *Pinus nigra* *Cedrus brevifolia* |

National need and priorities for future international collaboration are shown on the Table 23.

**Table 23: Awareness raising needs/Needs for international collaboration and networking**

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

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

### Access to Forest Genetic Resources

There is national regulation (Regulation on Forest Reproductive Material - Law 1991 - 2002) which controls the production and marketing of Forest Reproductive Material into and out of Cyprus. However, this regulation mainly deals with the quality and the identity of the material.

The collection and use of Forest Genetic Resources from the State Forests is controlled by the Department of Forests of the Ministry of Agriculture Natural Resources and Environment. Only after its permission, collection and use of reproductive material is possible. However, on Private Forests there is no rule/restriction established yet.

### Sharing of benefits arising of the use of Forest genetic resources

Although Cyprus has ratified the Convention for the Biological Diversity (CBD) and the resulted ITPGRFA, no national mechanism has been developed for the use of forest plant genetic resources and the fair and equitable sharing of the benefits arising out of their use.

## CHAPTER 8: The Contribution of Forest Genetic Resources to Food, Poverty, Alleviation and Sustainable Development.

As already mentioned, forest genetic resources in Cyprus are primary used for their environmental and ecological contribution, and secondary for their economic contribution. Such contributions are the protection of soil against erosion, improving and sustaining the hydrological cycle, preventing floods, conserving biodiversity, offering job opportunities and for recreation purposes. Under this concept, all the species forming forest ecosystems in Cyprus contribute to the food, poverty, alleviation and sustainable development.

For the better understanding of the economic, social, environmental contributions of forest genetic resources to the food, agriculture and forest development, research should be promoted to this direction. Furthermore, public awareness is necessary to be further promoted.

The national contribution of forest genetic resources management to the Millennium Development Goals is mainly concentrated to the environmental and ecological importance of the resources. Sustainable management of the genetic resources contributes to the adaptation to climatic changes, carbon sink, hydrological balance and biodiversity conservation.

# ANNEX I

# SOURCE OF INFORMATION


Cyprus Department of Forests, Ministry of Agriculture Natural Resources and Environment. Official documents and information.

Cyprus Agricultural Research Institute, Ministry of Agriculture Natural Resources and Environment. Official documents and information.

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