IPGRI

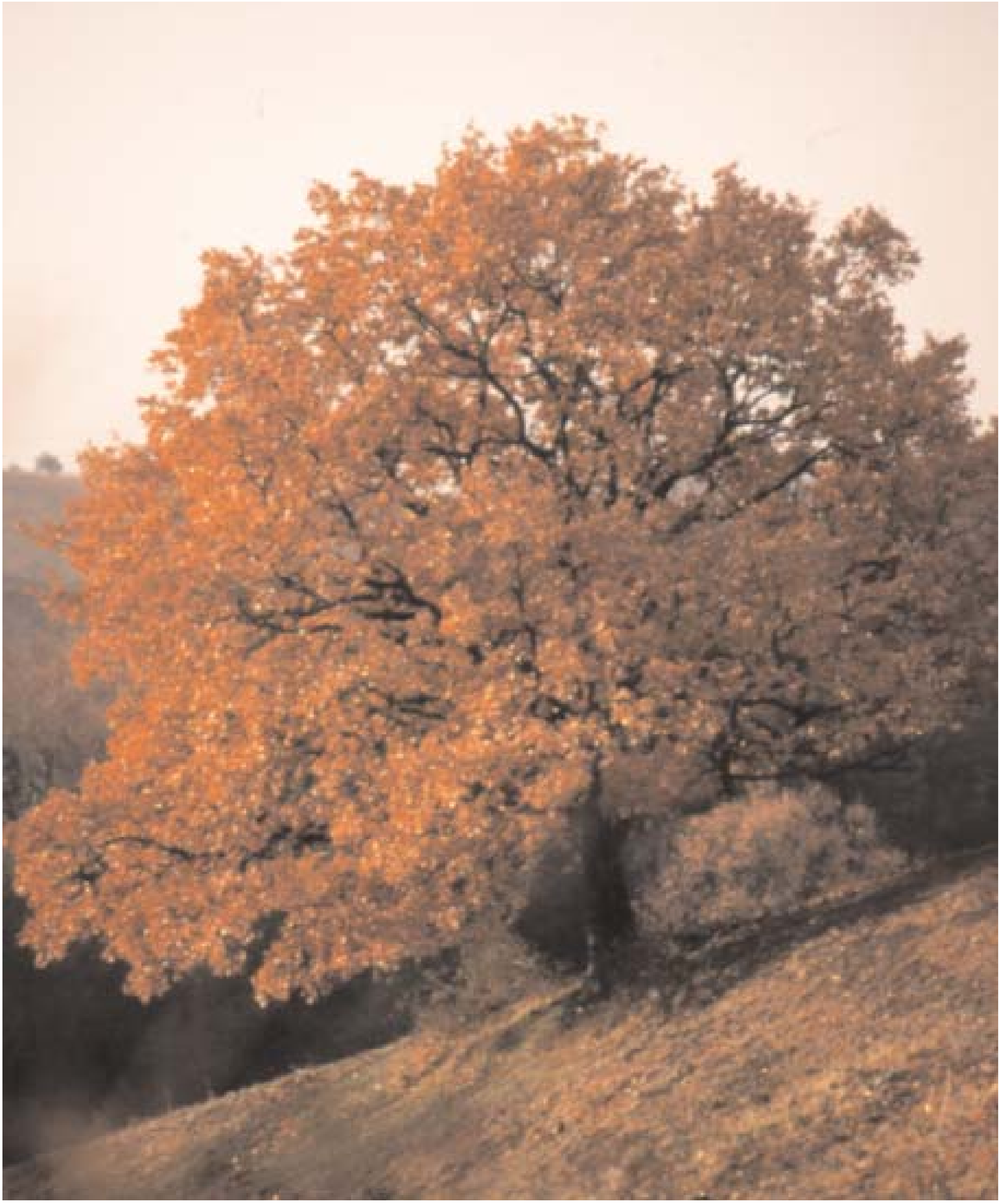
Mediterranean Oaks Network

Report of the second meeting
2-4 May 2002–Gozo, Malta

M. Bozzano and J. Turok, compilers

EUFORGEN

European Forest Genetic Resources Programme (EUFORGEN)



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Citation:
Bozzano, M. and J. Turok, compilers. 2003. Mediterranean Oaks Network, Report of the second meeting, 2–4 May 2002—Gozo, Malta. International Plant Genetic Resources Institute, Rome, Italy.

ISBN 92-9043-592-5

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Summary of the Meeting

Opening

Prof. Luís Gil, Chair of the Network, welcomed the participants from nine countries and thanked the Maltese National Coordinator, the local organizers and the government of Malta for the excellent organization and for their participation. He then introduced the expected outcomes of this meeting.

Mr Anthony J. Meli, Principal Scientific Officer of the Ministry of Agriculture and Fisheries, welcomed the participants and underlined the importance of genetic resources. He said it was very important for a country with such high human pressure to devote attention to conserving forest areas. He wished the participants a successful meeting and a good stay in Malta.

Eman Calleja, National Coordinator for Malta, briefly presented the programme of the meeting.

Jozef Turok, on behalf of the EUFORGEN Secretariat, gave a brief overview of upcoming meetings and activities in progress in the Programme at large. He also updated the participants on the progress in the recruitment of the new EUFORGEN Coordinator and introduced Michele Bozzano, temporary scientific assistant for EUFORGEN.

The participants introduced themselves. It was noted that Maxhun Dida (Albania), Roselyne Lumaret (France) and Bartolomeo Schirone (Italy) sent apologies for being unable to attend the meeting.

The agenda of the meeting was adopted.

Seminar

As recommended during the first Network meeting, a seminar on basic concepts and methodologies used in the conservation of forest genetic resources was organized for Network members. Prof. Gösta Eriksson gave two presentations entitled “Evolutionary genetics” and “Sampling in absence of genetic knowledge”.

Professor Eriksson agreed to distribute copies of his presentations to Network members (through the Secretariat). He highlighted the importance of maintaining evolutionary adaptability as the overall goal of forest gene conservation. Studying and understanding geneflow in Mediterranean oaks was emphasized during the discussion as a main challenge for forest gene conservation.

Darrin Stevens (Malta Environment Protection Department) drew the attention of the participants to the extremely small tree population sizes in Malta, giving as an example a native *Quercus ilex* population. The discussion then focused on local problems of forest gene conservation in Malta. Network members suggested possible solutions from both the technical and policy sides and presented existing similar problems, issues and examples from their countries. It was agreed that it would be useful to prepare a summary of this discussion. It was pointed out that this type of feedback from the Network is very important and it could be actively encouraged as a regular element in the mode of operation in the EUFORGEN Networks in the future. This item will be further discussed by the Steering Committee (June 2002).

Country reports: status and practices of gene conservation

All Network members presented either an introductory country report (Italy, Slovenia) or a country update. Research and public awareness activities were highlighted in most presentations. Prof. Hans Muhs on behalf of project partners presented outcomes of a relevant international research project on oaks, focusing on the re-colonization history and genetic diversity of *Quercus* species (*Q. petraea, Q. robur*) in Europe.

All participants will provide the Secretariat with an electronic version of their report, in the agreed format, by **31 May 2002**. Given the usefulness of this information, it was agreed that the country reports and updates should be published both in printed version and on the EUFORGEN web page (see section Information management below).

Research

The lack of knowledge about genetic resources of Mediterranean oaks was emphasized as a main constraint for their conservation and enhancement (see Report of the last meeting and country updates in this volume). The participants discussed research needs, and felt that these could be formulated into the following themes:

- geneflow in recently fragmented populations (with unfragmented populations as a control)
- genetic variability in marginal and central populations and its relationship to adaptive variationimpact of management regimes, from agroforestry to natural forests, on associated species
- impact of management regimes on mating patterns.

It was, however, also agreed that these research themes need to be integrated in a broader, multidisciplinary research effort. Ecology, socioeconomic and other aspects need to be properly addressed and linked with genetic research. The new research framework (FP) of the European Union, considered as a major opportunity for funding support, requires formulation of large projects with broader partnerships and longer duration (compared with the previous FP).

Given the urgent research needs and taking into consideration the possible opportunities, it was agreed to develop a research proposal on "Conservation and enhancement of biodiversity in Mediterranean oak ecosystems and their importance for rural population and landscape". The proposal will emphasize the importance of research on Mediterranean oak ecosystems (both ecological and economic aspects) for rural development in the region. Oak as a dominant and severely threatened part of the Mediterranean ecosystem should become the central element of a broader research effort.

The Network agreed to take responsibility for initiating the development of a proposal, by inviting research groups from other disciplines and by developing the genetic component. The selection of species will depend on the formulation of the research themes. Several pilot species could be selected to address the different questions and priorities. It was suggested that two existing proposals (submitted but not funded by the 5th FP) could be used as input to this proposal: the multidisciplinary cork oak proposal (M. Carolina Varela) and the genetic research proposal (B. Schirone). Links will be sought between the proposal and ongoing relevant efforts including the International Provenance Trial for cork oak (M. Carolina Varela).

The Network members from Italy (B. Schirone, R. Bellarosa) accepted responsibility for initiating the development of the project proposal, supported by other Network members and potential partners. They will circulate the first tentative concept note to a group of key partners and Network members by **30 September 2002**. The EUFORGEN Secretariat will provide B. Schirone with information about ongoing discussions and requirements related to the 6th FP before **31 May 2002**.

Discussion on sharing of gene conservation responsibilities

J. Turok introduced the proposal made by the group of Network chairpersons as a new vision for future activities of EUFORGEN. This proposal will be discussed during the forthcoming Steering Committee meeting. While the accomplishments of the EUFORGEN

Networks include setting up groups of specialists, exchange and production of information, standardized language and methodologies, and facilitation of technical guidelines, the vision for the future is based on providing more direct support for implementation of gene conservation action. Networks of gene conservation units for target species within their distribution areas would be carefully designed and implemented through "master plans", or voluntary agreements among countries. A "master plan" for a given species would set priorities for conservation efforts. It would also provide the basis for recommending, coordinating and monitoring the practical gene conservation measures taken in the forests.

The basic step in each conservation effort is to create reliable information (and inventory) of the distribution of resources. The Network recognized the importance of promoting this task for Mediterranean oaks during its first meeting (see Report). Therefore, M. Bozzano presented the results of an investigation completed by the Secretariat on distribution maps. He mentioned different sources of data, such as the *Flora Europaea* as well as Network members themselves. He explained the different software packages used. A map showing the natural distribution area of *Quercus suber* was presented, based on the work done within the International Provenance Trial. It was agreed that the Network members from the countries concerned would provide amendments in order to finalize the map. The final, integrated map is shown below. The Network members concerned will provide their feedback to the Secretariat by **30 June 2002**.

M.C. Varela offered to explore possibilities for developing maps of other species. The Network members will send existing maps to M.C. Varela by **30 September 2002**. The Secretariat will provide information regarding the use of software and technical support.

Natural distribution range of *Quercus suber*.

Information management and public awareness

M. Bozzano introduced the new information platform. Since the status of national activities on forest genetic resources in Europe is changing, and there is increased attention by non-Network members, information will be maintained in a new, user-friendly platform, available on-line. In the new EUFORGEN web site it will be possible to browse information (particularly country reports and country updates) through a multicriteria search and it will be easy to obtain the information needed. The web site will be on-line by the end of May. The importance of having standardized format for reports and updates was stressed. The participants agreed to proceed with the preparation of a photo CD, which would include characteristic images of Mediterranean oaks and their genetic resources. This task was agreed upon during the first meeting but little response has been received. Each country will be responsible for providing images on different aspects (full tree, landscape, traditional uses, morphological characters, etc.). Original images (preferably slides) will be sent to Nihal Özel, who offered to be in charge of collecting the images and transferring them to the photo CD. The Network members will send slides to N. Özel by **31 May 2002**. The collection will be available to all members, who might use it for public awareness purposes, publications, web pages, etc.

The idea of a public awareness video was discussed again. In order to accomplish this task some initial investment would be required. Efforts will be needed on the part of each country to collect footage on local species. E. Calleja offered to prepare a proposal to be presented as a feasibility study. The proposal will be circulated to Network members by **30 June 2002**.

M. Bozzano presented the EUFORGEN bibliographic database on gray literature. The Network members were encouraged to continue providing references for this database. The database has been frequently used on-line from the web page. An access form has been developed and will be circulated to Network members by **15 May 2002**. It was clarified that each member should restrict contributions to those available in her/his own country.

The table of species was presented during the meeting and participants provided comments. The new table, along with this Summary of the meeting, will be circulated to all Network members as well as countries outside the Network by **15 May 2002** (Secretariat).

Date and venue of next meeting

The next meeting of the Mediterranean Oaks Network will be held (tentatively) in **autumn 2003**. Vlatko Andonovski reiterated his offer to organize the meeting in Macedonia FYR, which was appreciated by the participants. The Secretariat will follow up and provide information to all countries in due course.

Other business

M.C. Varela presented a document “Proposed programme of forest conservation activity on cork oak woodlands in the Mediterranean region”, developed by WWF and received through the FAO *Silva Mediterranea* Network. The participants discussed the contents and format of this proposal and agreed to provide a written comment. The Secretariat will contact the *Silva Mediterranea* on behalf of the Network.

Adoption of the report

The report was adopted and distributed to the participants.

Conclusions

The local organizers were thanked for their kind efforts in preparing and organizing this meeting. It has provided the participants with an insight into the unique situation of forest gene conservation in the Mediterranean region. Luís Gil thanked the participants for their work and declared the meeting closed.

Scientific Contributions

Germplasm conservation of Mediterranean oaks in Italy: distribution and genetic structure of cork oak (*Quercus suber* L.)

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Introduction

According to the definition of Mediterranean oaks proposed by Schirone and Spada (2000), the following oak species are present in Italy: *Quercus ilex, Q. coccifera* (including *Q. calliprinos), Q. suber, Q. cerris, Q. trojana, Q. macrolepis, Q. frainetto* and *Q. pubescens.* Hybrids *Q. crenata (Q. cerris* × *Q. suber)* and *Q. morisii (Q. ilex* × *Q. suber)* are also present.

Of all the above-listed oak species, only cork oak is of interest to Italian public authorities and the scientific community, mainly because of its notable commercial value. *Quercus ilex, Q. cerris, Q. frainetto* and *Q. trojana* are merely considered as firewood; *Q. coccifera* is appreciated only for its landscaping potential, while *Q. macrolepis* is protected as an endangered species. Politically and scientifically, therefore, the main Italian activities aimed towards the conservation of oak germplasm focus on cork oak.

A very important innovation for the conservation of cork oak relies support at the political level. Thanks to Sardinian farmers and to the notable sensitization and information-sharing policy led by EUFORGEN with the national administration government, the National Plan on Cork and Cork Oak Breeding was launched. Supported by the Italian Ministry of Agriculture, the document establishes techniques and policies required for the correct management of cork oak stands. As in the Cork Oak Network, the main measures aimed at germplasm conservation are listed as well as transformation aspects, commercialization and research hints.

At the same time, at a scientific level, some research investigations and meeting events have dealt with cork oak. Among others, of note is the FAIR5-CT97-3480 project "Optimization of cork oak management in support of community policies for reforestation and cork production", coordinated by an Italian Unit led by P. Belletti from the University of Turin. Their investigations within the project served to deepen the base knowledge on seed quality, the biology of conservation and the physiological mechanisms involved in some aspects of germination. However, new protocols for the conservation of cork oak seeds longer than what normally is allowed by the available technologies (one year) have not been set up yet (Belletti *et al*. 2002).

In the same period, the Sardinia Administrative Region published two volumes dedicated to cork oak culture (Dettori *et al*. 2001; ERSAT 2002) which, though of some utility for farmers, are of little scientific interest.

In this report we briefly summarize our studies concerning the following two aspects that have been mainly addressed in our laboratories (University of Tuscia-Viterbo):

- the development of the distribution map of cork oak in Latium (administrative region of Central Italy) as part of ongoing work for the completion of the National Inventory of cork oak stands in Italy
- a genetic characterization of Italian oaks and a further evaluation of the intraspecific biodiversity of cork oak germplasm based on the analysis of nrDNA 5,8S sequences.

Distribution map of cork oak in Latium

The starting point of our work was based on the collection of every kind of informative material about past and present distribution localities of cork oak. We used many different data sources, from old archives to more recent databases and documents, with particular reference to those provided by the regional Headquarters and local Stations of the National Forestry Service.

The first identification of cork oak growing sites was obtained on the Regional Technical Map (CTR, scale 1:10 000), supported by topographic information. The subsequent field surveys enabled us to confirm the species' presence and the extent of the populations we found. This latter aspect was further refined with GPS (Global Positioning System) and aerial photographs (scale 1:2000). Isothermic curves, basal areas and the population structure were deduced from the field data obtained in 61 newly surveyed cork oak plots. As a result, 10 different kinds of stands were described on the basis of forest typology (see Box 1).

Box 1. Forest typologies of cork oak stands

Pure cork oak stands (presence >90%)
Mixed cork oak stand (presence =40-90%)
Mixed stand with cork oak (presence <40%)
Sparse cork oak stand (presence >50%)
Sparse stand with cork oak (presence <50%)
Highly sparse cork oak stand
Mediterrean maquis with cork oak
Riparian vegetation with cork oak
Grazing with cork oak
Cropland with cork oak.

From the data obtained and the subsequent correlations with the environmental parameters and characteristics it was observed, among other aspects, that (1) contrary to what is generally believed, cork oak is able to grow on calcareous soils, and (2) its distribution is more dramatically determined by precise climatic limits. For example, cork oak has been shown to be easily overcome by other taxa when present below the 15°C isotherm.

The *Distribution map of cork oak in Viterbo, Roma and Latina Provinces*, i.e. the Latium portions of territory where cork oak is present, was then developed by means of all the collected data (Figure 1) and the populations' borders were finally digitized and georeferenced on the CTR topographic basis, by using the GIS (Geographic Information System) Arcview 3.1 computer programme.

Mapping of the detailed geography of cork oak distribution in Italy has now been accomplished for five regions (Apulia, Calabria, Latium, Sardinia and Tuscany) out of the eight (Campania, Liguria and Sicily are still missing) where *Q. suber* is actually present.

The whole Italian distribution map is likely to be completed in the next couple of years.

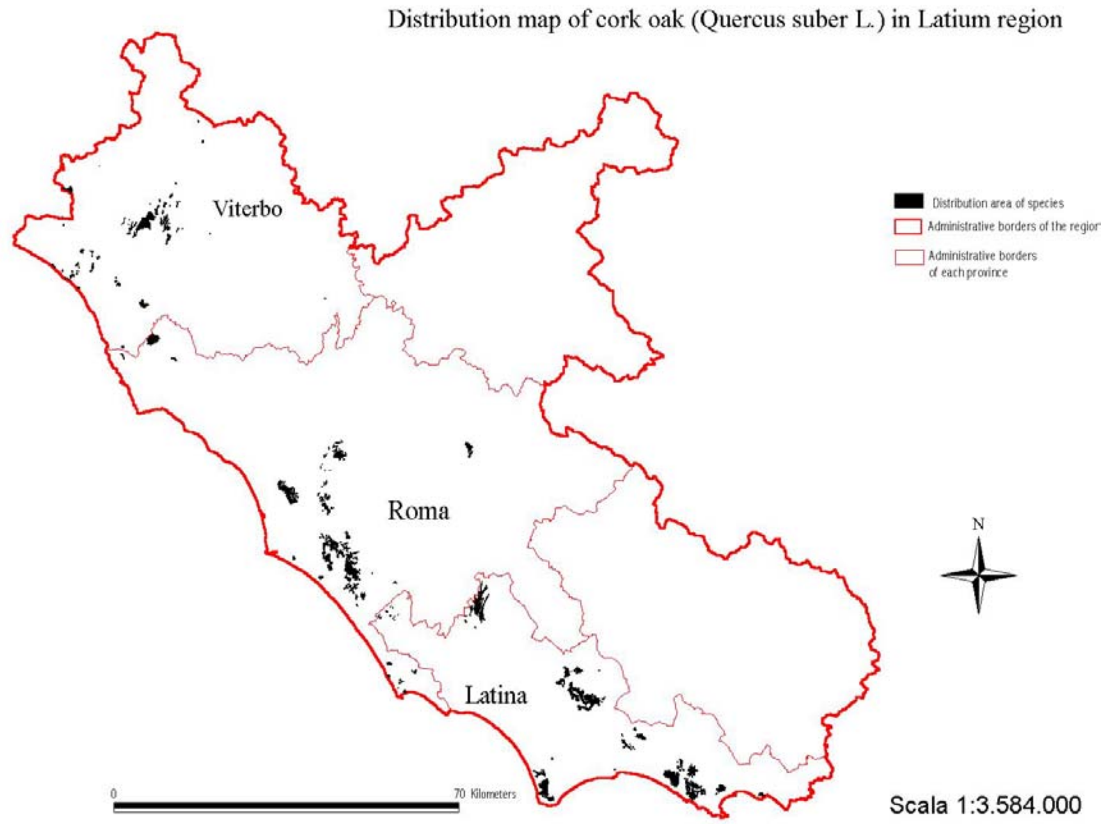

Figure 1. Region of Latium (Central Italy, Thyrrenian coast): distribution map of cork oak populations and stands.

Inter- and intraspecific analysis of cork oak germplasm

We can consider as concluded our research project based on the use of nrDNA Internal Transcribed Spacer (ITS) sequence analysis to further improve our knowledge of the affinities and relationships of Mediterranean oaks.

We first applied this molecular marker to several species of *Quercus*, specifically those actually present in Italy; then we concentrated our efforts on cork oak from southwestern Europe and North Africa. A large part of the study is dedicated to Italian populations of cork oak, mainly those collected in Latium.

Recently, two research teams (Samuel *et al*. 1998; Manos *et al*. 1999) assessed the molecular systematics of *Quercus* using independently generated ITS sequences. Their results were contradictory and the two obtained phylogenetic trees diverged, with special regard to the species belonging to section, or subg., *Cerris*. The results of Samuel's team, in particular, were incongruent with the traditionally accepted concept of "*Cerris* group". According to Mayol and Rossellò's (2001) hypothesis, the contrasting phylogenetic histories obtained by the two teams were generated from the analysis of paralogous ITS sequences by Samuel *et al*. rather than from technical differences of the two laboratories, and the subsequent mixing of different data resulted in visible discrepancies in the elaboration of the phylogenetic relationships. Therefore, in our study, new, high-stringency protocols have been set up in order to overcome the possible, undesired, presence of paralogous sequences.

We have analysed, according to the Schwarz classification, two species of subg. *Schlerophyllodrys* (*Q. ilex* and *Q. coccifera*); five species of subg. *Cerris* (*Q. macrolepis, Q. trojana, Q. cerris, Q. suber, Q. crenata*) and four species of subg. *Quercus* (*Q. robur, Q. petraea, Q. pubescens, Q. frainetto*) by means of ITS nucleotide sequences. The resulting data are perfectly in accordance with the taxonomic classification of the genus *Quercus* and with all results previously obtained by means of different molecular markers (IGS, Bellarosa *et al*. 1990; seed storage proteins, Bellarosa *et al*. 1996) (Figure 2) (manuscript in preparation).

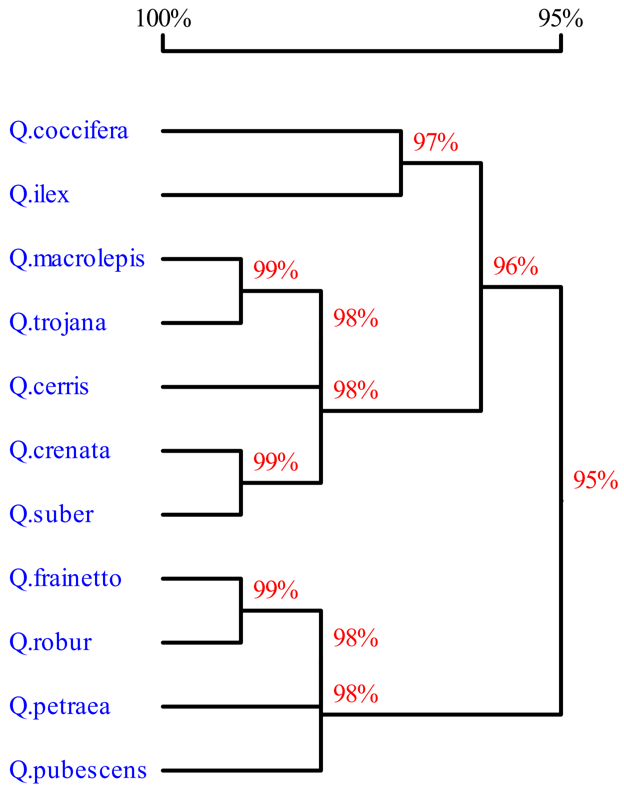

Figure 2. Dendrogram (homology tree) of 11 Italian *Quercus* species, based on the shared homologies (% is indicated) of the ITS sequences. The tree was computed by use of the UPGMA approach (Sneath and Sokal 1973) with the DNAMAN Package (Lynnon Biosoft 1999).

Indeed, the homology tree obtained for *Q. ilex* and *Q. coccifera* is in agreement with the concept of subg. *Schlerophyllodrys* of Schwarz; all the species supposed to belong to the subg. *Cerris* are in the same clade; *Q. crenata*, a hybrid between *Q. suber* and *Q. cerris*, showed a unique ITS sequence, which appeared to be more similar to that of *Q. suber* than to the other parent. This could be interpreted as a gene conversion phenomenon, an event rather common in hybrid species (Baldwin *et al*. 1995) or, alternatively, could depend on the different genetic contribution of the two parents, along the generations. In the subg. *Quercus* clade there is a strong affinity between *Q. frainetto* and *Q. robur* which may reflect the same strong morphological and ecological affinities existing between the two species. Our analysis allowed us to separate *Q. petraea* and *Q. robur*, two sympatric species generally supposed to be difficult to distinguish by using molecular markers (cf. Muir *et al*. 2001).

Finally, *Q. pubescens* and *Q. petraea,* the two more xerophytic species, stand on separate clades and appear to be equidistant from the other two species of the subgenus.

Our results—for the species in common with the other two research teams—are fairly well in agreement with those published in Manos *et al*. (1999), not only in consideration of the derived phylogenies but also relative to the main structural and biological features of the analysed ITS sequences (Bellarosa *et al*., manuscript in preparation). On the other hand, we believe that special caution should be used by molecular systematists with the results obtained by means of molecular markers before drawing phylogenetic conclusions. A more precise understanding of the phylogenies and the existing relationships between taxa and populations should emerge from the implementation of different data obtained by ecological, morphological and molecular analyses.

In this regard, especially at the population analysis level, more attention should be paid to molecular analysis involving larger parts of the genomes (microsatellites, AFLP, etc.).

A further aspect of our research consisted, then, of the use of the same molecular approach to improve the knowledge on the genetic structure of cork oak in a large geographical context and to estimate the existing biodiversity among Italian populations of this species.

The cork oak germplasm used was from field trials established in Roccarespampani (Latium, Italy) as part of a Concerted Action Programme (FAIR 1 CT 95-0202). The populations' provenances are listed in Table 1.

Table 1. Collecting sites for the nrDNA analysis of cork oak.

Country	Site (distribution area)
Algeria	Guerbès
France	Le Rimbaut – Pyrenèes
Italy	Sicily, Sardinia, Elba, Latium, Apulia
Morocco	Boussafi
Portugal	Alcacer do Sal
Spain	Cataluña litoral
Tunisia	Al-Mecna

The ITS sequence comparisons revealed the existence of three distinct groups, on the basis of sequence homology and the calculated pairwise distance (Figure 3): a first one comprising samples with Franco–Iberian origin, a second one grouping together North African and Italian provenances, Sicily and Sardinia islands included, and a third one constituted only by the population from Apulia (Eastern Italy).

These results are in perfect agreement with those obtained by Toumi and Lumaret (1998) and Jimenez *et al.* (2000) on the basis of isoenzyme and cpDNA analysis, with the striking exception of the Apulian population, representing a previously undetected source of polymorphism.

Particularly relevant is the apparent genetic isolation that seems to characterize the Apulian samples, which is likely to confirm what was already pointed out (Bellarosa *et al.* 1996; this volume) about the ecological importance that seems to invest the Apulian region.

Based on the coincidence of all the data in our hands, in our opinion we can definitely assume a general scheme for the genetic diversity of cork oak. This scheme is able to subdivide the actual geographical area of presence of the cork oak into three genetic pools: the large Franco–Iberian (1) and Afro–Italian (2) and the small Apulian one (3), which probably constitute the three main areas of diversification of the species. A future development of our research is intended to use more powerful molecular markers (microsatellites, AFLP) in order to define in more detail each of these genetic groups. Moreover, as a critical point for an efficient programme of conservation of the intraspecific biodiversity, special care will be used in analysing small and isolated populations like those from Mediterranean islands (Baleari, etc.).

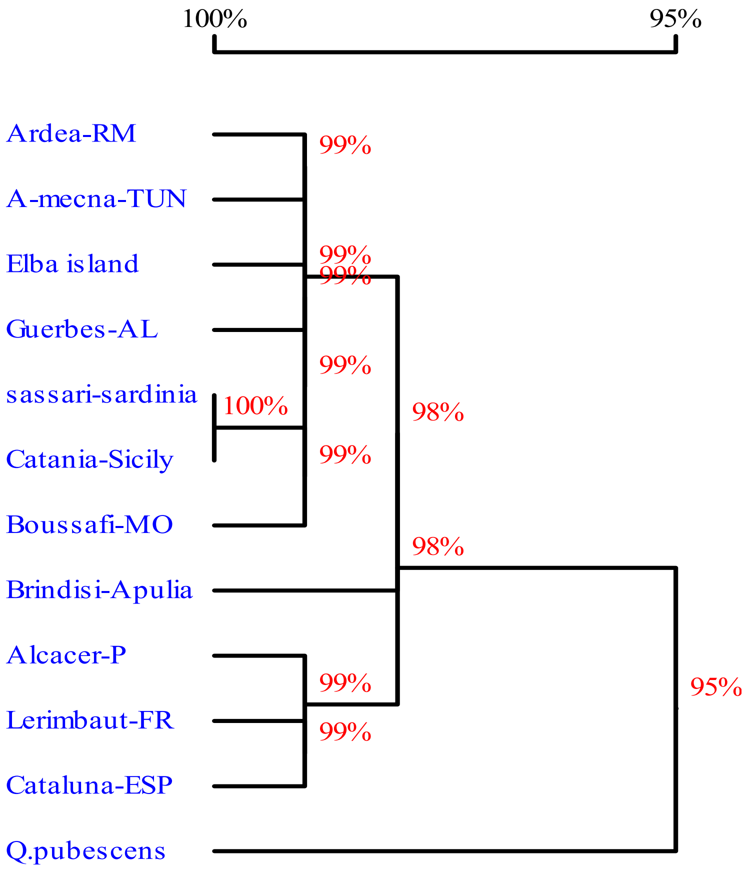

Figure 3. UPGMA method homology tree derived on the basis of ITS sequences of 11 cork oak provenances representing the entire diffusion area of the species. *Q. pubescens* is used as outgroup.

Finally, as part of a project committed by the local government (ARSIAL), we tried to evaluate the amount of genetic variability in the cork oak populations in the Latium region (collecting sites are reported in Table 2). Given the limited extension of the studied geographical area and the reduced informative nature of the ITS sequences, as marker, for such a detailed kind of analysis, the Latium populations proved indeed to be all closely related with other Italian samples but different from them, although to such a small extent it was hard to quantify (Figure 4). A further refinement of the study is thus necessary and will make use of the above-mentioned, more powerful, molecular tools.

Table 2. Cork oak collecting sites in Latium.

Site	Province†
Ardea	RM
Castelporziano	RM
Fossanova	LT
Montalto	VT
Monte S. Biagio	LT
Tuscania	VT

† Provinces of Rome (RM), Viterbo (VT) and Latina (LT).

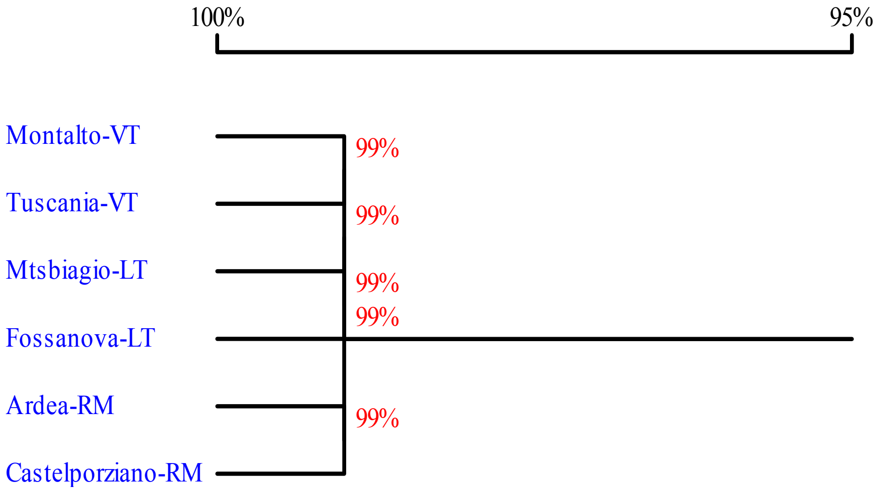

Figure 4. Homology tree of six collecting sites of cork oak in the Latium region.

Conclusions

Our work focused on the utilization of ITS (nrDNA) sequences as a molecular marker to elucidate relationships between and within *Quercus* species. We studied samples from all the oak species actually present in Italy, the larger part of which constitutes the Italian set of Mediterranean Oaks.

The ITS-derived homology tree is consistent with the classification of Schwarz (1964) and reflects the ecological affinities between species in the same clade.

Within-species diversity evaluation was possible and used to confirm, on a molecular basis, the existence of two main areas of cork oak differentiation (the Franco–Iberian region and North Africa–West Italy) plus a third one located in Apulia (southeastern Italy), which represents the easternmost site of presence of the species.

However, high-potential and more informative molecular markers are needed for a more detailed evaluation of cork oak population biodiversity, especially in the closely related stands and in order to overcome the existing levels of heterozygosity. For this, protocols for microsatellites and AFLP analysis are being set up in our laboratory.

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Review of the activities related to Mediterranean Oaks conservation in Spain

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Introduction

This paper is a review of the activities related to *Quercus* conservation that our group has carried out in recent years. This work has been done in the framework of the programme promoted by the General Direction for Nature Conservation for conservation of genetic resources, first aimed at cork oak (*Quercus suber* L.) and later holm oak (*Quercus ilex* L.) and Kermes oak (*Quercus coccifera*). The main objectives of this programme were to:

- make an inventory of the resources of the species
- deepen the knowledge base on the genetic structure of cork oak (molecular variation and adaptative traits)
- provide recommendations for the most adequate management to preserve genetic diversity and the actions needed to maintain not only the populations but also their potential.

The programme began with the delimitation of provenance regions for cork oak (Díaz-Fernández *et al.* 1995), which involved a review of its distribution in Spain, and the assessment of its environmental variability. This allowed detecting the existence of some marginal populations, geographically isolated and in limiting habitats, but with a high conservation value. At the same time, the study of genetic variability was initiated, both the adaptative variation, through the installation of provenance trials, and the neutral variation, by means of molecular markers.

Characterization of marginal populations

The definition of regions of provenances for cork oak involved a review of its Spanish range. The survey showed the occurrence of a particular type of stand, so-called 'marginal populations', with a high potential value for conservation purposes. However, their small size and the limiting habitats cause a poor response ability against disturbances.

Ten of these marginal stands were selected and characterized (Figure 1) (Díaz-Fernández *et al*. 1996; Gil *et al*. 1997). In each population, a preliminary description was undertaken, gathering information on location, access, ownership, surface, characteristics of the stand and previous management. Forest structure and dynamics were evaluated in the field, mainly their demographic features such as the presence and importance of regeneration.

Two main trends were found in this study: low number of young trees and poor regeneration, and loss of cork oak dominance. The results obtained allowed the classification of the populations according to their greater or lesser decline risk (Table 1). Criteria taken into account for this classification included the density of adult trees, density of regeneration, percentage of loss of dominance, surface of the populations and presence of other cork oak stands in the neigbourhood.

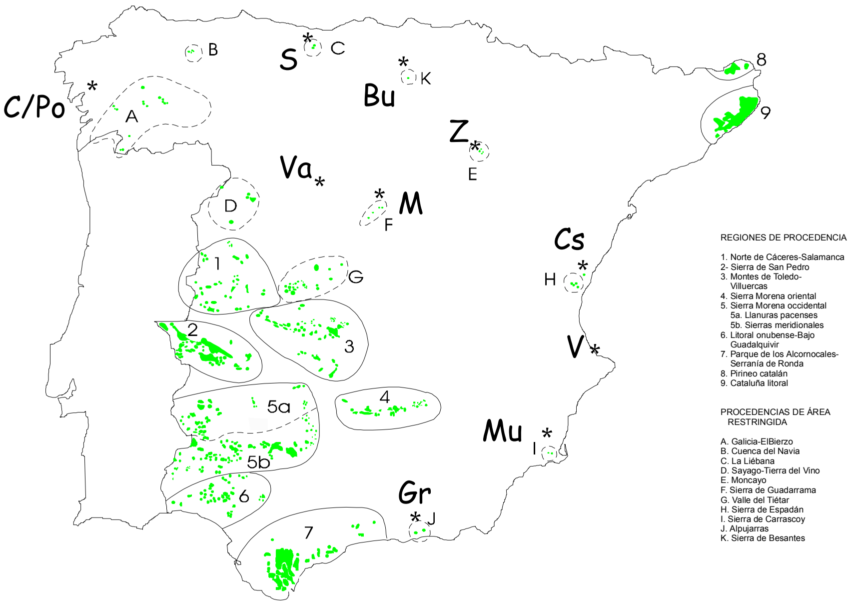

Figure 1. *Quercus suber* - Location of the studied marginal populations (refer to Table 1 for classification of the populations according to their greater or lesser decline risk).

Table 1. *Quercus suber* - Risk of decline of each population. 0 = min; *** = max.

Pop.	Gr†	S	Cs	Va	Z	C/Po	Bu	V	M	Mu
Risk	0	*	*	*	*	*	*	**	**	***

† See Figure 1 for locations.

Field trials

The first meeting of the *Quercus suber* Network within EUFORGEN took place in Rome in December 1994. The necessity of provenance and progeny trials as a basis for adaptative and heredity studies and as a way of *ex situ* conservation was raised early in this meeting. In 1996 a Concerted Action allowed the beginning of work aimed at the establishment of field trials distributed in Portugal, Spain, Morocco, Italy and France.

Within this Concerted Action, two international trials were planted in Spain: a provenance trial with 32 populations from all the species' natural range and a progeny trial with 66 families from three provenances (Almoraima-Spain, Alportel-Portugal and Aïn Rami–Morocco, 22 families per provenance). Their installation was financed under an agreement with the General Direction for Nature Conservation of the Spanish Environment Ministry. This agreement also allowed planting a national provenance trial with 13 provenances and two replications and a smaller international provenance trial in Puerta de Hierro (Madrid) within the Forest Genetic Improvement National Centre. The latter trial has the advantages of being next to the research centre (Politechnical University of Madrid) and counts on continuous technical and human support for its maintenance. The main objective of this trial is to test the more suitable methodologies for adaptative studies which will be applied in the future on the other trials.

Seed collection was carried out during autumn–winter 1996. As mentioned above, 32 populations were collected for the international trials: 3 in France, 5 in Italy, 2 in Tunisia, 1 in Algeria, 7 in Morocco, 6 in Portugal and 7 in Spain, with an additional Portuguese-Spanish one. The eight Spanish populations were completed up to 13 for the national trials (Figure 2).

When the seed size was studied, a relationship with geographical origin was found. Acorns from southern populations were bigger in length, width and weight than those from northern latitudes or higher altitudes (Figure 3a) (Castro Noval *et al*. 2000). This geographical pattern has been found in some other *Quercus* species (Jensen 1986; Aizen and Woodcock 1992). It has been given two possible explanations. On one hand, populations in southern latitudes have longer growing seasons which allows the fruit to get bigger, while northern populations or those from higher altitudes have shorter fruit development periods (Stebbins 1971). On the other hand, bigger seeds from southern origins can produce seedlings with deeper roots capable of facing the summer droughts that are more likely in these southern locations (Baker 1972).

The plant culture was carried out during 1997. Three nurseries were used: Pegoes (Portugal) for the international trials and Puerta de Hierro and Almoraima (Spain) for the national ones. The seed size was assessed to influence the seedling size: bigger seeds produced higher plants (Figure 3b). The nursery techniques were also important as plants with different heights were produced in the three nurseries.

Plantations were made in February–March 1998. Two locations (besides Puerta de Hierro for a more controlled trial as mentioned above) were chosen: Selladores (Jaén) and Monfragüe (Cáceres), with different ecological features (Table 2). The international progeny trial and one replication of the national provenance trial were placed on Selladores, whereas the second replication of the national trial and the international provenances were planted on Monfragüe. They all have a similar design: 30 complete randomized blocks with experimental plots of four plants per provenance or two plants per progeny (Table 3).

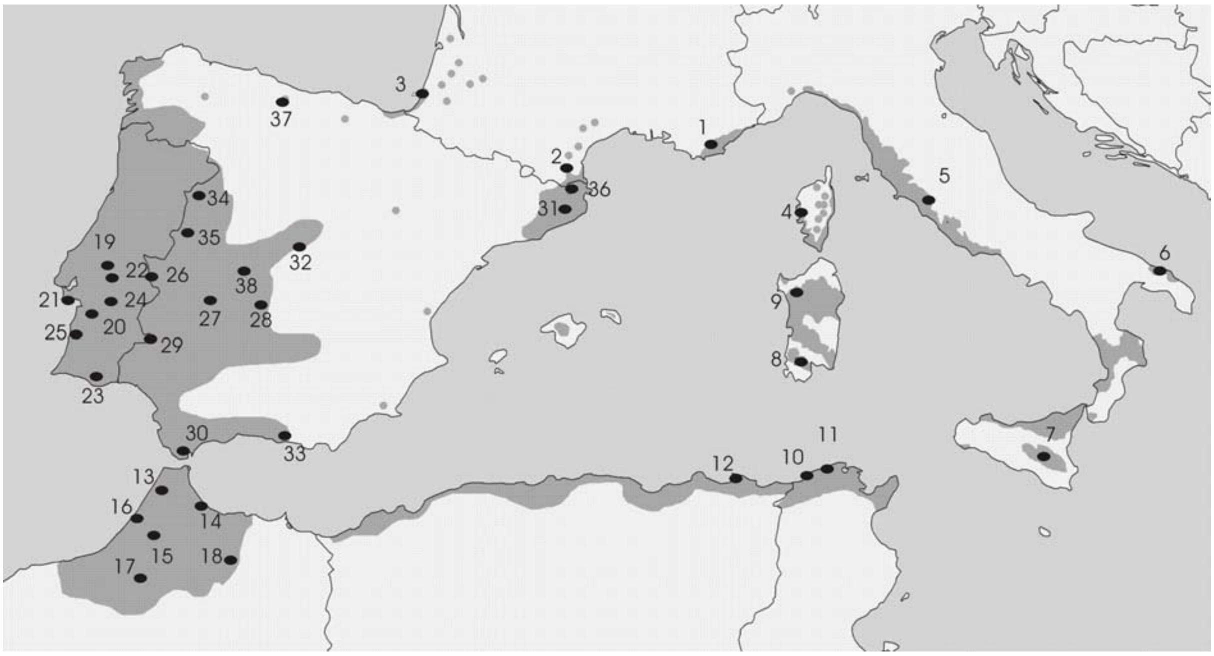

Figure 2. *Quercus suber* - Sites of seed collection. 1–25: provenances in international trials; 26–38: provenances in Spanish national trials.

A survival review has been done every year since plantation (spring 1998). Trials in Selladores had a survival rate in autumn 2001 of 77.6% for international progenies and only 41.7% for national provenances. The results were better in Monfragüe, with over 85% in both national and international provenances (Table 4). Our efforts are focused now on the conservation of these field trials as valuable material to carry out different research on adaptative variation. A very frequently observed feature was the loss of apical dominance (over 80% of the plants). Different phenotypes have been defined according to the presence/absence of apical dominance and the growing pattern. The evolution of these phenotypes is being assessed.

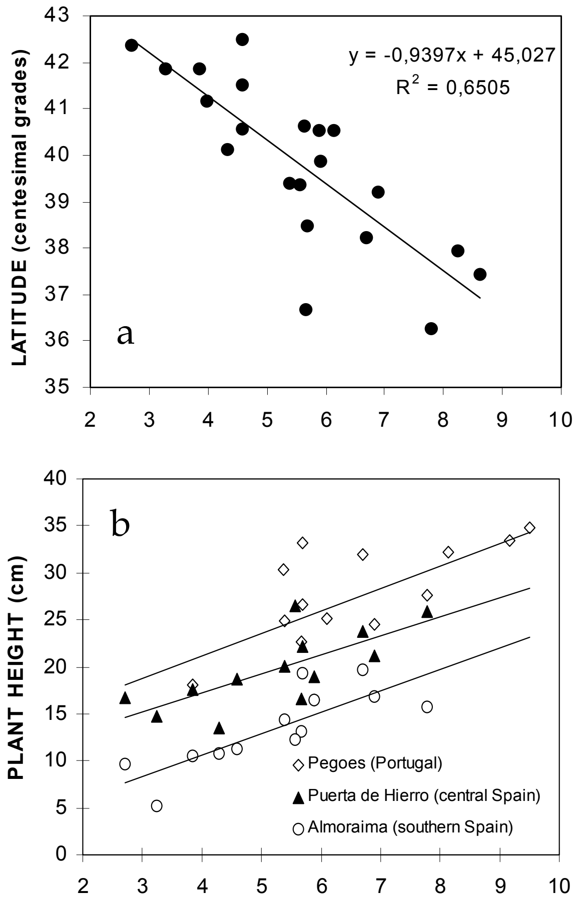

Figure 3. *Quercus suber* - (a) Relationship between seed weight (g) and latitude (centesimal grades); (b) relationship between seed weight (g) and plant height (cm) for three nurseries.

Table 2. *Quercus suber* - Geographical and ecological characterization of the Spanish trial locations.

Character	Lugar Nuevo: Monfragüe Natural Park. Serradilla (Cáceres, Extremadura, Spain)	Selladores: Sª Andújar Natural Park. Baños de la Encina (Jaén, Andalucía, Spain)
Altitude	361 m	850 m
Latitude	39°51' N	38°21' N
Longitude	6°2' W	3°51' W
Slope	NW facing slope (15%)	SE facing slope (8%)
Rainfall		
Annual	775 mm	655 mm
Summer	14 mm	4.3 mm
Average temperature		
Annual	17°C	14.7°C
Minimum	8.3°C	5.9°C
Maximum	27.6°C	25.3°C
Bedrock	Slate	Quartzite
Soil type	Haplic alisol (FAO)	Eutric cambisol (FAO)
Vegetation	*Eucaliptus* plantation with *Calluna, Erica, Cistus*, etc. understory	Shrubs of *Cistus*, *Erica*, *Phyllirea*, etc. and scattered trees of *Quercus suber*, *Q. ilex* and *Q. faginea*

Table 3. *Quercus suber* - Trial designs.

International provenances	Plot	Blocks	Trial
Entries	4 plants	32 provenances	30 blocks
Design	square	complete randomized blocks	
Spacing and surface	initial: 3x3 m final: 6x6 m	32x4x3x3 = 1152 m^2	1152x30 = 34 560 m^2 = 3.456 ha
Number of plants	initial:4 final:1	initial: 32x4 =128 final: 32x1 = 32	initial: 128x30 = 3840 final: 32x30 = 960
International progenies	**Plot**	**Blocks**	**Trial**
Entries	2 plants	56 progenies	21 blocks
Design	square	incomplete randomized blocks	
Spacing and surface	initial: 3x6 m final: 6x6 m	56x2x3x6 = 2016 m^2	2016x21 = 42 336 m^2 = 4.234 ha
Number of plants	initial:2 final:1	initial: 56x2 =112 final: 56x1 = 66	initial: 112x21 = 2352 final: 56x21 = 1176
National provenances	**Plot**	**Blocks**	**Trial**
Entries	4 plants	13 provenances	30 blocks
Design	square	complete randomized blocks	
Spacing and surface	initial: 3x3 m final: 6x6 m	13x4x3x3 = 468 m^2	468x30 = 14 040 m^2 = 1.404 ha
Number of plants	initial:4 final:1	initial: 13x4 =52 final: 13x1 = 13	initial: 52x30 = 1560 final: 13x30 = 390
Puerta de Hierro	**Plot**	**Blocks**	**Trial**
Entries	1 plant	15 provenances	16 blocks of 42 plants
Number of plants	–	42 plants	42x16 = 672 plants
Spacing and surface	0.8x0.8m	42x0.8x0.8 = 26.88m^2	26.88x16 = 430.08 m^2 = 0.043 ha

Table 4. *Quercus suber* - Trial results. INI: initial number of plants in spring 1998; S98: survival in autumn 1998; (*): dead plants that were replaced; S99: survival in autumn 1999; S00: survival in autumn 2000; N: number of plants; %: percentage in respect of the initial number of plants.

	International provenances (Monfragüe)		International progenies (Selladores)		National provenances (Monfragüe)		National provenances (Selladores)		International provenances (Pta. de Hierro)	
	N	%	N	%	N	%	N	%	N	%
INI	3840	100.0	2352	100.0	1560	100.0	1560	100.0	672	100.0
S98 (*)	3615	94.1	2114	89.9	1409	90.3	1272	81.5	578	86.0
S99	3756	97.8	1849	78.6	1501	96.2	1131	72.5	618	92.0
S00	3553	92.5	1742	74.1	1424	91.3	936	60.0	569	84.7

Adaptative variation

The main objective in the Puerta de Hierro trial was to study the differences among provenances in their responses to drought and cold temperatures, as these are the climatic factors thought to limit cork oak distribution.

Water relations were assessed during summer 2000 by means of pressure-volume curves. For this experiment five provenances from very different environments were selected: Alportel (Portugal), Aïn Rami (Morocco), Sicily (Italy), Potes (Spain) and Alburquerque (Spain). From mid-June to mid-September the summer was very dry, the predawn water potential (ψ_p) fell to -2.0 MPa and the osmotic potential at the turgor loss point (ψ_π^0) decreased around 1 MPa in all the provenances (Figure 4a). Then the trial was watered and the plants recovered their osmotic potentials, but no differences among provenances could be described. So we concluded a high plasticity of the species in parameters related to resistance to water stress (Castro *et al.* 2001). The following year (2001) a similar experiment was carried out to assess the osmotic adjustment capability of the species. We focused on the two Spanish provenances and kept control plants, which were watered all summer. Differences in ψ_π^0 between stressed and control plants involved an osmotic adjustment of 0.6 MPa, but no significant differences between provenances were observed (Figure 4b).

Chlorophyll fluorescence has been measured since November 2000 on 10 provenances in the Puerta de Hierro trial. The relationship of variable (Fv) to maximum (Fm) fluorescence is interpreted as a measurement of photosystem II efficiency and its decrease is related to stressful situations caused by drought or cold temperatures (Maxwell and Johnson 2000). During winter 2000–2001 a decrease of Fv/Fm values down to 0.5–0.6 was recorded, with no significant differences between provenances. In the spring of 2001 the old leaves recovered values similar to those registered for new leaves (0.7–0.8). During the summer there was a slight decrease, with all provenances showing very similar values. The higher variation was observed during the cold winter 2001, with a drop from 0.65–0.7 in October to minimum values of 0.3–0.1 in February. For this period the differences between provenances were significant. Those populations from continental (El Pardo, Spain), northern (Sta. Coloma, Potes, both from Spain) or high altitude (Haza de Lino, Spain) origins maintained higher alues than those from southern and/or coastal locations (Figure 5).

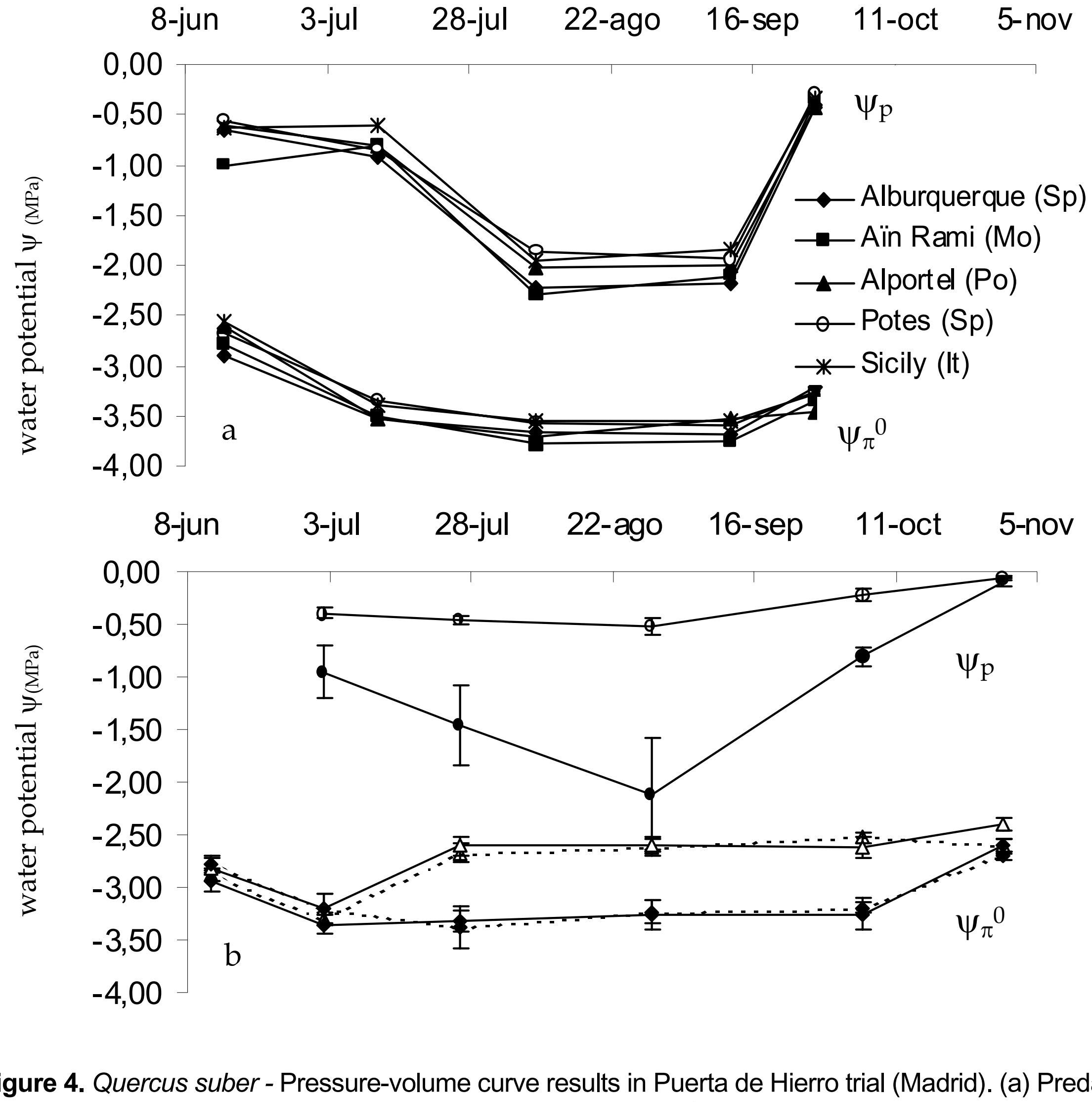

Figure 4. *Quercus suber* - Pressure-volume curve results in Puerta de Hierro trial (Madrid). (a) Predawn water potential (ψ_p) and osmotic potential at turgor loss point (ψ_π^0) for 5 provenances in summer 2000. (b) Predawn water potential (ψ_p) and osmotic potential at turgor loss point (ψ_π^0) in summer 2001; open symbols are control plants, closed symbols are stressed plants, dashed line corresponds to Alburquerque (Spain), continuous line corresponds to Potes (Spain).

Another feature thought to be related to strategies to face drought and cold is the vegetative phenology; a late flushing provenance will be more affected by summer drought and an early flushing one by late frosts. A phenological index (0: dormant bud, swollen buds, 2: broken buds, 3: visible leaves, 4: elongating shoots, 5: hardened leaves, Duccousso *et al*. 1996, modified) has been used to follow weekly the provenances in the Puerta de Hierro trial during the 2000 flushing period. As mentioned above, the loss of apical dominance is very frequent in cork oak seedlings. This was the reason why two twigs were selected on each plant: one as apical as possible and another basal, close to the ground. The results showed that the basal phenology was earlier than the apical with, for example, 15 days of difference for swollen buds (index=2). There were significant differences between provenances, for both the apical and basal phenology (Figure 6).

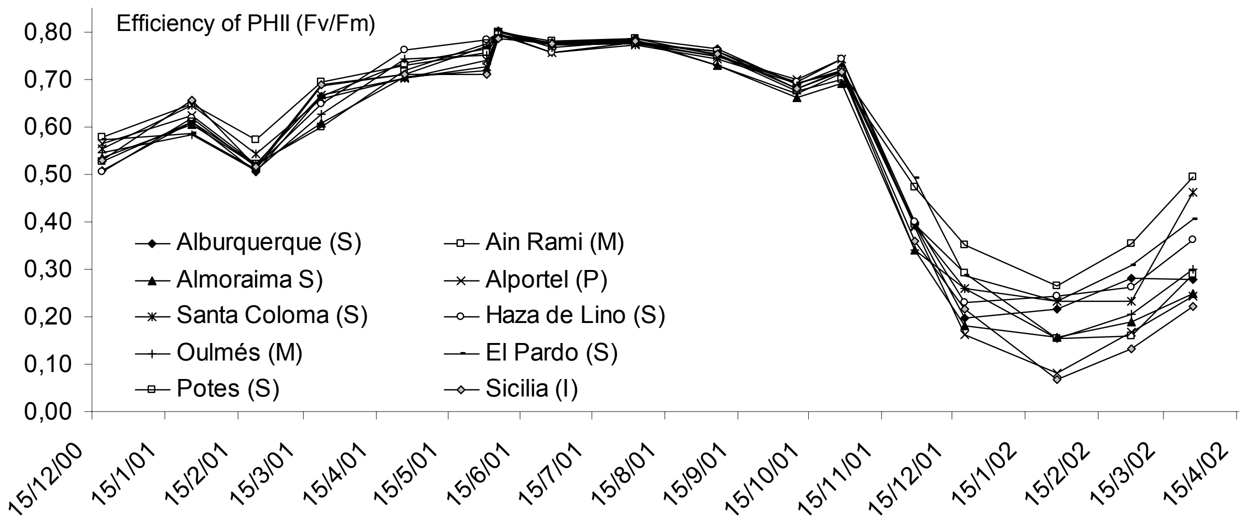

Figure 5. Chlorophyll fluorescence results for 10 provenances in Puerta de Hierro trial (Madrid).

Flowering phenology was also studied, mainly its relationship with acorn maturation cycles. Two patterns of acorn development have been described in cork oak: annual cycle, in which seeds are dispersed the first autumn after flowering, and biennial pattern, in which acorns mature in the second autumn, after a quiescent period. The occurrence and frequency of each cycle was investigated in several Iberian populations (Figure 7). The origin of the three traditionally recognized crops in the species (early autumn, late autumn and early winter) was assessed and related to the flowering patterns.

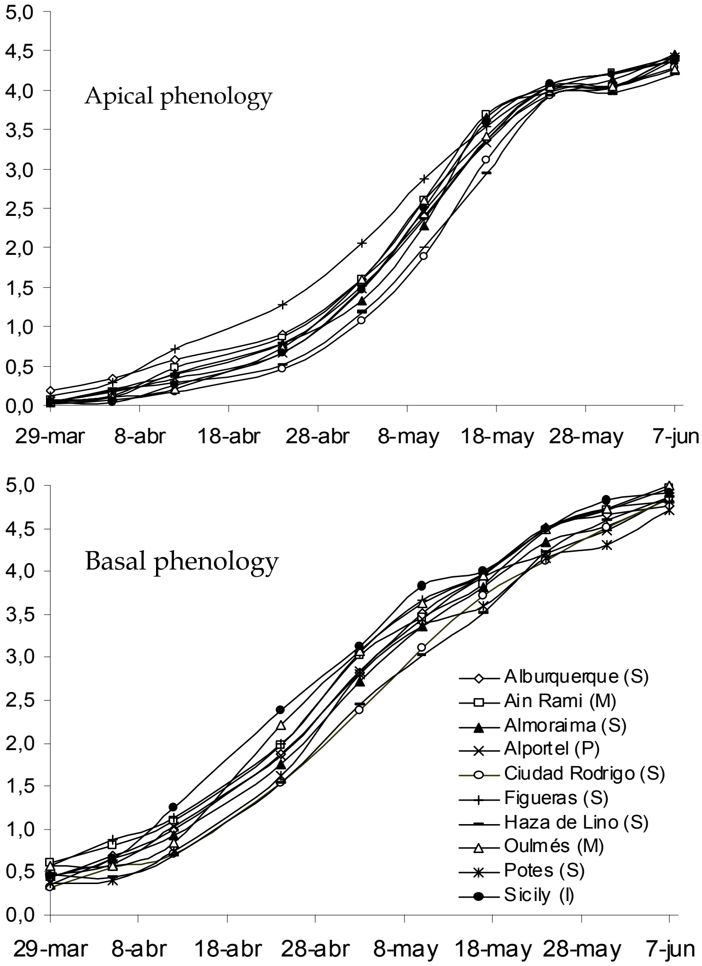

Figure 6. *Quercus suber* - Phenology in 2000 for 10 provenances of Puerta de Hierro trial (Madrid).

Figure 7. *Quercus suber* - Location of the populations included in the study of reproductive phenology.

A positive relationship (r^2=0,48) was obtained between latitude and the percentage of trees with biennial acorns (Figure 8). There was a tendency of northern populations (Potes and Sestrica) to have more biennial or mixed individuals. Southern populations generally showed more annual individuals, but the relationship with latitude was less strict. Within each population, precocious individuals bore a greater percentage of annual acorns, while late-flowering individuals bore a greater percentage of biennial acorns. The geographic tendency observed, with higher frequency of biennial acorns in northern populations, is in accordance with the comments by other authors (Camus 1938; Elena-Roselló *et al.* 1993).

Both annual and biennial maturation cycles appear throughout the studied Iberian cork oak stands. The acorns ripening in an annual cycle form the intermediate and late crops, depending on individual differences in seed dispersal, while biennial acorns form the early crops. Thus, the crops corresponding to the same autumn and winter period originate from flowering on two consecutive springs. These results do not confirm the idea of a continuous or multiple female flowering, widely accepted to explain the multiplicity of crops in Iberian *Q. suber* (Natividade 1950; Schwartz 1964; Franco 1990).

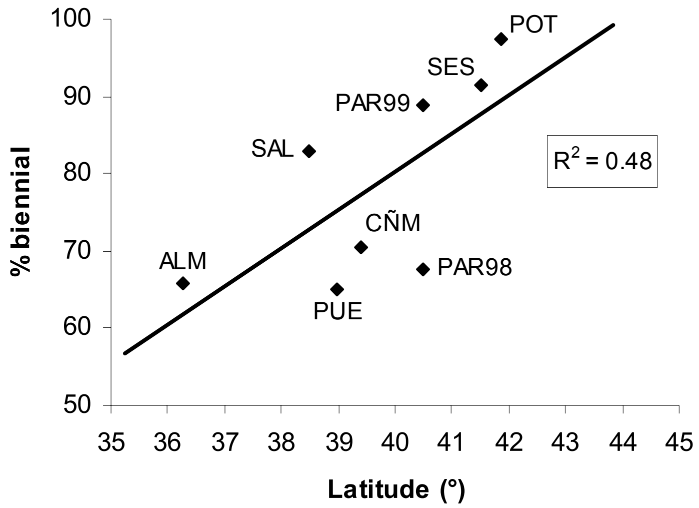

Figure 8. *Quercus suber* - Regression between latitude and the percentage of trees with biennial acorns (% biennial).

The results of this study revealed the influence of phenology in the presence of acorns that undergo a biennial cycle. Late-flowering individuals tended to have more quiescent flowers and this pattern is similar in all the studied populations under different environmental conditions. Within the same population, late individuals have a shorter period of acorn development than precocious trees. This is consistent with the interpretation of biennial acorn ripening as an adaptation to environments with short vegetative periods (Corti 1955; Elena-Roselló *et al.* 1993).

Genetic diversity

Isozyme studies

Studies on genetic diversity using biochemical and molecular markers were initiated with the study of isozyme variation on cork oak. Twenty-two populations were sampled, mainly in the Iberian Peninsula but with representatives from Morocco and Italy. The objective was to establish general levels of diversity for the species, as well as to determine the geographic distribution of high- and low-diversity areas. Allelic frequencies and parameters of intra- and interpopulation diversity (expected heterozygosity, allelic richness, number of polymorphic loci, coefficient of differentiation) were calculated. Contribution of each population to total diversity and total allelic richness was estimated following the method developed by Petit *et al.* (1998), as an approach to knowing its importance as a genetic resource.

The results of this work have been previously reported (Jiménez *et al*. 1999, 2001). The most remarkable conclusions are the higher levels of diversity in southern and central Spain, while less variation was found in Italy and in the north of the Iberian Peninsula. This points to the importance of the Peninsula as a centre of diversification and/or as a glacial refuge. Another significant fact is that, from population contribution, marginal areas provide a significant component of the total diversity, mainly owing to their divergence from the mean genetic composition.

Cytoplasmic variability

Chloroplast DNA variability has been investigated by means of PCR-RFLP techniques on 57 cork oak populations. The most striking result was the differences between western and eastern Iberian Peninsula. A great homogeneity was found in the former, while several different haplotypes occurred in the Mediterranean stands. This variability comes from an introgression with holm oak. Sierra Morena mountains, a region with high enzimatic diversity, appears also as the area with the highest diversity for cytoplasmic markers.

To test if the pattern shown by the introgressed populations can be explained through several local hybridizations, we compared the patterns of cork oak and holm oak in sympatric populations (Jiménez *et al*., submitted). Kermes oak was also included because of its taxonomic proximity to holm oak and as a reference for the situation between two closely related species.

In Table 5, populations and the haplotypes found in each one are shown. A common pattern is not observed when comparing the haplotypes of each species in the same population. In most cases, different variants are found for holm oak and cork oak. This could be interpreted as a result of ancient exchanges, followed by differential migrations and divergence. However, some cases where both species share the haplotypes testify to the occurrence of more recent exchanges.

The pattern found for kermes oak and holm oak shows high haplotypic similarity, as a consequence of their taxonomic proximity.

Conclusions and implications for conservation

During the last 10 years an important effort has been made to obtain the knowledge needed to manage cork oak genetic resources. The studies have involved different issues such as provenance delimitation, study of marginal populations, and genetic and adaptative variation assessment.

On one hand, genetic studies show that mating system characteristics (allogamy, wind pollination) play an essential role in the maintenance of intrapopulation diversity. This implies that recovery programmescan be undertaken through promotion of sexual reproduction (*in situ* or *ex situ* activities, depending on particular cases). Cork oak presents very scarce variation in chloroplast genome studies. Most of the haplotypes found come from introgression events with holm oak. The meaning and mechanism of these exchanges must still be elucidated but, meanwhile, this evolutive singularity must be considered in the management of those populations.

The Spanish marginal populations have important value as a genetic resource but an unbalanced structure has been found with a frequent failure from regeneration to the following age classes. The absence of regeneration is the most worrying threat in cork oak populations. These marginal areas must not be neglected in conservation strategies, since they represent an important and divergent component of species diversity. Some of them (mainly southern and eastern populations) reveal a distinct evolutionary history, with reduced geneflow from other sites. This fact should be taken into account when planning seed movements or reintroductions.

On the other hand, the results of the ecophysiological studies can be interpreted as cork oak having a high plasticity in response to drought and a significant variation among provenances in parameters related to low-temperature stress. It could be concluded that cold temperatures might be a limiting factor for the species' expansion, even more important than drought. This should be taken into account when selecting seed origins for afforestation programmes.

Table 5. Comparison of haplotypes (chloroplast DNA) in sympatric populations of cork oak, holm oak and Kermes oak. For each population and species, the haplotypes found are indicated. ***Bold italic*** numbers indicate those variants shared between species.

Population	*Quercus* species	Haplotypes
Coín	*suber*	1
	ilex	22, 14, 21
	coccifera	24
Constantina	*suber*	29
	ilex	27
Aracena	*suber*	1, 2
	coccifera	9, 17
Selladores	*suber*	10, 20, ***18***
	ilex	18
	coccifera	18
Puebla de Alcocer	*suber*	1, 13
	ilex	13, 1
	coccifera	13
Azaruja	*suber*	1
	ilex	26, 16
Serra da Arrabida	*ilex*	28, ***29***
	coccifera	29
Mata dos Medos	*suber*	29
	coccifera	27
Gabriel y Galán	*suber*	1
	ilex	8
El Pardo	*suber*	1
	ilex	25
Sierra de Espadán	*suber*	6
	ilex	5, 11
Liébana	*suber*	1
	ilex	19
Guetaria	*suber*	1
	ilex	7
Santa Fe de Montseny	*suber*	3
	ilex	12, 4

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Country Reports

Albania

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Introduction

Albania has a rich flora with about 3250 native vascular plant species (Ecological survey, 1994; Paparisto 1989). About 30% of Albanian forest territory is occupied by 12 oak species: *Q. ilex* L. (Holly oak), *Quercus coccifera* L. (Kermes oak), *Q. calliprinos* Webb, *Q. macrolepis* Kotschy-Vallonea, *Q. trojana* Webb (Macedonian oak), *Quercus robur* L. (Common oak), *Quercus frainetto* Ten. (Hungarian oak), *Q. cerris* L. (Turkey oak), *Q. pubescens* Willd. (Pubescent oak), *Q. virgiliana* (Ten.) Ten., *Q. petraea* (Mattuschka) Liebel (Chestnut oak) and *Q. dalechampi* Ten. (Mitrushi 1955; Paparisto 1989).

Conservation and use

The oak forests in Albania are distributed throughout the country (Table 1). In the past the data about oak species were limited to general information on genus (*Quercus* sp.) with little information on species. However, some descriptions about oak species, their locations and regions exist (Mitrushi 1955) as well as some information about their use and regeneration (Dida 1989).

The Forest and Pasture Research Institute in Tirana has carried out some studies about the Genetic Network conservation of oaks *in situ* (Dano 1996).

Table 1. Genetic resource network conservation (RNI†) of oak species in Albania.

Region	Forest unit	Parcel	Longitude	Latitude	Area (ha)	Altitude (m asl)
Shkoder	Shllak 1	23a,32	19°35'20"	42°07'00"	40	600–700
	Shllak 1	59	19°36'00"	42°08'20"	35	700
	Gomsiqe	74-84	19°38'15"	42°08'20"	284	500
Kukesi	Tej Drinit bardhe	136,137	20°25'00"	42°02'20"	82	900
	Goske	25 ac	20°09'00"	42°05'00"	20	600
Puke	Iballe	16,17	20°01'15"	42°12'25"	27	1000
Mirdite	Qafmolle	16	19°52'00"	41°47'00"	42	300
Librazhd	Stravaj	85,86	20°22'20"	40°58'10"	50	870
	Lepushe	72a	20°29'00"	41°01'15"	23	1000
	Rajce	17,18	20°33'00"	41°08'10"	59	1300
Korçe	Gorrice	75-92	20°54'00"	40°55'20"	280	1000–1300
Erseke	Orgocke	67a,68a	20°25'00"	40°23'30"	52	1000
Gramsh Katerlis	Katerlis	59,60	20°05'30"	40°50'00"	54	700–900
Durres	Kuraten	2-10	19°35'00"	41°35'00"	100	150
Delvine	Dhrovjan	59,60	20°11'00"	39°54'00"	50	200
Permet	Hotove	26	19°24'00"	40°21'50"	24	1000
Lushnje	Gjeneruke	38-40	19°34'00"	40°58'30"	50	80–120
To tal					1382	

† RNI=Integrated Natural Regeneration.

Integrated Natural Regeneration (RNI)

This kind of *in situ* conservation is generally used for many genera but not especially for oak species. In recent years in Albania these resources have been seriously degraded by tree-cutting and grazing. They need recognition and a study of the actual situation to propose some measures for regeneration or to find other areas for oak conservation. Two years ago a study was begun by the Forest and Pasture Research Institute in Albania, supported by a Forestry Project, for collection of seed of the major oak species. We collected seeds for *Q. frainetto, Q. cerris* and *Q. pubescens* and planted them at the Botanical Garden in Tirana. Currently 100 stands of each species are maintained as *in situ* conservation; 1 kg of *Q. pubescens* seed is maintained as an *ex situ* measure. Results of the *in situ* conservation trials are shown in Table 2.

Table 2. *In situ* conservation trials and seed source recommendations.

Species	Growing region	Recommended seed source
Q. petraea (Chestnut Oak)	Central mountains	Dobresh, Tirane
	Southeastern mountains	Gorice, Korce
Q. frainetto (Hungarian Oak)	Central mountains	Prenjas, Katerlis
	Southeastern mountains	Lepushe, Librazhd
Q. cerris (Turkey Oak)	Central mountains	Dobresh Tirane
	Southeastern mountains	Gorice, Korce

Change in inventories

The main inventories were carried out for Albanian forests generally and oaks especially in 1953, 1968 and 1985. In recent years the Forest Management Plans for the forests have been developed, which are transferring some forests to the Community and designating others as state forests in Albania. Recent data for oak in the country are lacking, so this year the National Forests Inventory is being developed in Albania supported by a Forestry Project (WB) and we hope to have more data for oaks soon.

Change in relevant policy and legislation

The oak forests mostly near the urban zones are being transferred to the Community according to the Forest and Pasture Strategy of the Forestry Sector in Albania. This will provide the Community with greater possibility to use and manage oak in a sustainable way, according to the forest management plan recommended for specific areas and conditions.

Change in research

The Forest and Pasture Research Institute is developing the project "The identification of forest stands to produce seeds for main forest species" supported by the Ministry of Agriculture and Food. The objectives of this study are: recognition of the actual situation of forest reserve species, selection of plus trees, collection of seeds, and creation of *ex situ* conservation, etc.

Some tentative and small projects are developing in Albania for planting oak trees such as *Q. ilex* and *Q. robur* in oak ecosystems that are very degraded.

Change in tree improvement

Oak in Albania is mostly managed as coppice stands because of overcutting and overgrazing. The oak is very degraded by the cutting of branches for animal fodder during the winter. Now we are trying to manage the oak forest for grazing and for wood but to respect some measures for cutting the trees and to select some best trees for new regeneration. This is very difficult and needs education and training of local people.

Change in country priorities

Albania now is trying to use native species, especially broadleaves such as oaks. Foresters and owners are interested in developing a strategy and action plan for planting and regeneration of native species because there have not been good results from introducing conifers in this area and people want multiple use of the forests.

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Bulgaria

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Mediterranean oaks in this country include Turkish oak (*Quercus cerris* L.), Hungarian oak (*Quercus frainetto* Ten.), Pubescent oak (*Quercus pubescens* Willd.), Kermes oak (*Quercus coccifera* L.) and Cork oak (*Quercus suber* L.). The last one is an introduced species from Spain. Kitanov (1941) and Stefanov (1942) laid the basis of the first studies of these species as concerns their spread in Bulgaria, as well as their ecology and biology. Investigations have been developed in monographs and dissertations of Genov (1985), Petrov (1994), Marinov *et al.* (1995), etc. A study on the genetic structure of Mediterranean oak populations by isozyme markers was started in Bulgaria in 2001 (Zhelev, pers. comm.).

Kermes oak

The first information about *Q. coccifera* in Bulgaria concerns the spread of the species, and thus the basis of scientific research on it was laid down (Kitanov 1941). Kermes oak is the only evergreen oak, spread throughout the country. It is found mostly as a bush (1–2 m high) and rarely as a tree (6–7 m high).

The range of this species includes the hot submontane vegetation zone. Kermes oak is thermophilic, drought resistant and tolerant of soil conditions. It grows mainly on the slopes, but also can be found on flat dry and sunny spots, on shallow and poor soils where it has a slow growth.

In Bulgaria the Kermes oak is found in the Strouma valley, to the south of the Kresna gorge (in the region of Kamenitza, Kalimanci, Kulata and Novo Hodjovo villages) as well as in the southern part of Mesta valley (between Gurmen and Debren villages). It grows in forests mixed with other oaks (*Q. cerris, Q. petraea, Q. robur, Q. pubescens*), xerotherm deciduous and evergreen species (Velchev and Vasilev 1982).

As in the near past, at present some *Q. coccifera* stands are under intensive pasturage and uncontrolled felling. These factors, as well as the slow growth of the species, are the reasons for the decrease of its natural range. It is known that in the past the vertical distribution of this species has been up to 1000 m altitude (Kitanov 1941; Steffanov 1953), but at present its highest habitat is in Katunci State forestry, where it is spread up to 430 m asl (Alexandrov *et al.* 2000). The total area of the stands with different percentage of Kermes oak in them is 152.4 ha, and the partial area of the species is 62.9 ha with the largest proportion in Tsaparevo State forestry: 95.3 ha and 36.9 ha for the total and partial areas, respectively (Alexandrov *et al.* 2000).

The density of the stands with large *Q. coccifera* content is low. In 69% of stands it is 0.2–0.4 and in forest management plans a reconstruction is foreseen. In these sites it is hard to form more resistant and productive stands, so that planting of Austrian pine is a misapplication. The reconstruction of these stands will cause reduction of the genetic potential of the Kermes oak in its most northern distribution and therefore it is necessary that some of them be designated as protected areas (Alexandrov *et al.* 2000). *Quercus coccifera* has no economic value and that is why it has not been included in the afforestation programs, nor have genetic studies been done. Kermes oak, however, is included in the Red Data Book (1984) of rare and endangered plant species in Bulgaria. That is why future practices should be directed towards the designation of protected areas and seed production stands. Study of the genetic structure of Kermes oak populations by isozyme analysis is underway.

Hungarian (Italian) oak

The first study has been done on the course of growth (Petkov *et al.* 1958); later Kalinkov (1960) defended a dissertation on the forestry qualities of this species and a number of other investigations were made.

The Hungarian oak is one of the frequently found oak species in Bulgaria. It grows in the plains, as well as on foothill slopes with southern, western and southwestern exposures, on heavily compacted and dry soils, up to 1000 m altitude. It often forms mixed stands with *Q. cerris, Q. petraea* and *Q. pubescens*. The soils on which the Hungarian oak forests grow are shallow to middle deep, sometimes stony and subject to surface erosion.

In the past it occupied an even greater range in the plain regions of the country. The reduction of its areas is a result of the strong human influence on the woodlands. This pressure was most intensive in the regions with more fertile soils and well-developed agriculture. During the 1950s part of the forests in the plains regions were transformed to agricultural lands. As a result of the Hungarian oak area reduction in some of these regions only small forests, tree groups or single trees have remained. To conserve the most valuable genetic resources of this species in Bulgaria 348 seed stands, 19 reserves, 2 national and 6 nature parks have been declared. The seed stands are from 40 to 180 years old and are situated from 50 to 850 m altitude. Their total area amounts to 4432.8 ha. The national and nature parks containing *Q. frainetto* cover a total area of 195 938.8 ha.

Last year in Bulgaria a study started on the genetic structure of Hungarian oak populations by izosyme markers and 15 populations have been already studied (Zhelev, pers. comm.). A PhD dissertation on morphological variation of the species is also in preparation (Tsavkov, pers. comm.).

Turkish (Adriatic) oak

This species is widely distributed in this country, vertically from 54 m (Ropotamo) up to 938 m (Gabra), and horizontally it is found mainly in the Danube Hilly Plain, northeastern part of Bulgaria, eastern part and foothills of the Balkan mountains, the Tundza River hilly plain and Strandzha mountain.

The Turkish oak comprises the biggest part of the mixed oak stands, and together with the Hungarian oak, pubescent oak and durmast, forms vast forests. It is also part of mixed broadleaf forests that are comprised of *Acer campestre* L., *Ulmus minor* Mill., *Carpinus orientalis* Mill., *Fraxinus ornus* L., *Quercus frainetto* Ten., *Quercus pubescens* Willd., etc. The stands up to 40 years old cover the biggest area (60.2%) followed by those over 100 years old (21.0%).

A trend of decrease in the total area of the high-stem Turkish oak forests occurred until 1975, with a slight increase after that. However the low-stem forests also have increased their area. Given the resistance of the Turkish oak ecosystems, its high productivity and capacity for renovation (by seeds and sprouts), the decrease of the area is too great. The high-stem Turkish oak growing stock has dropped from 5.2 million to 2.9 million m^3, the low-stem growing stock, however, has enlarged from 801 000 to 3 million m^3, and the coppice forests from 6 million to 19 million m^3.

In 1953 the growing stock was 1 007 167 m^3 and was comprised of high-stem forests (115 687 m^3) and low-stem forests (891 480 m^3), while in 1990 they were 73 630 m^3 and 693 482 m^3 respectively.

In 1953 the area of the high-stem forests was 65 081 ha and of the low-stem forests, 355 655 ha. Their area considerably decreased until 1975 (high-stem forests – 20 225, forests for reconstruction – 42 952 ha and low-stem forests – 175 303 ha) but after that gradually increased until 1990 (high-stem forests – 31 051 ha, forests for reconstruction – 53 777 ha and low-stem forests – 173 574 ha) (Marinov *et al.* 1995). It is clear that coppice forests determine the growing stock.

In the past *Q. cerris* was deemed to be a species of secondary importance and in most cases it has been artificially replaced in its natural populations with Austrian pine. During the last decade, however, the importance of this species has been re-evaluated and there is a tendency towards its restoration in its natural habitats. A PhD thesis is dealing with the study of Turkish oak variability in Strandza and Balkan mountains (Erbakamov, pers. comm.).

The condition of the Bulgarian *Q. cerris* forests during the last 10-15 years shows that these forests are important, and their area should be restored. The Turkish oak stands have good and high productivity as well as a high grade (bonitat I–III). A way to conserve the genetic pool and to increase the Turkish oak forests is by collecting acorns from permanent seed stands, whose area is 2143.2 ha (Alexandrov *et al.* 2000).

Pubescent oak

Pubescent oak is found all over the country, especially in Bulgaria's southern parts, where it forms vast, heavily thinned and sparsely covered stands. The main reason for this is the excessive cutting carried out in the past. Pubescent oak grows on hills, uplands and foothills up to 1200 m altitude. It is found on southern and sunny slopes, often on heavily compacted, dry and limy soils. The sites that it most often occupies are poor, eroded and steep and, according to the forest management plans, are initiated for reconstruction. The largest area occupied is situated in the central part of south Bulgaria. It forms mixed stands with the other oak species, *Fraxinus ornus, Carpinus orientalis, Acer monspessulanum* L., *Acer campestre, Cotinus coggygria* Scop. and other deciduous species. It takes well on dry, barren lands that hardly warm up in the summer, and where rock and semi-rock material prevail. This is the reason for its poor productivity on such terrains.

This species is highly light demanding, does not bear shading and fruit-bearing is rare (average period of 5–7 years). The acorns germinate quickly but are sensitive to extreme climatic conditions. That is why the reproduction is unsatisfactory in general (Alexandrov *et al.* 2000).

The seed stands of this species are at the age of 40 to 140 years and are distributed from 120 to 277 m altitude. Their total area amounts to 40.8 ha. It is included in the structure of eight reserves and four national and nature parks in order to preserve its genetic resources.

It is advisable in future work that this species be used for afforestation in Dobrudzha and on the riverbank slopes with southern exposure, as well as on terrains with more shallow, poor and eroded terrains with sunny exposures.

Cork oak

Quercus suber is cultivated in the southern regions of Bulgaria, including the south coast of the Black Sea (Petrov 1961, 1994). The introduction of cork oak in this country started in 1954 and about 1500 ha of experimental–productive plantations have been created to date.

The provenances used in this country have very good adaptive characteristics, which are within the range of the genetically conditioned norm of reaction of these provenances for southern Bulgaria (Petrov 1994).

The forest plantations of this species have survived without significant damages. They are resistant to low temperatures (to –18°C), and the average annual rainfall and its distribution throughout the year are favourable for the growth of the cork oak. The drought duration during the vegetation period is shorter than in its distribution area and the rainfall is considerably more, which is the reason for its better growth.

The cork oak plantations provide an opportunity to produce cork for regional needs as well as for export. The phytosanitary conditions are very good. The 45–year–old plantations are a confirmation of the acclimatization of the species and are also a strong testimonial about the spread of cork oak afforestation.

Plantations older than 15 years already produce acorns and in some spots natural regeneration is observed. This is an indicator for acclimatization of *Q. suber* in the southernmost parts of the country.

A seed orchard from this species is located in "Dervishitsa" (State Forestry "Parvomai") at the foot of Ograzden mountain. It is the northernmost one on the Balkan peninsula and the annual acorn yield is 3 to 10 t. It gives the opportunity to create new plantations from the most resistant and acclimatized individuals and also to export the acorns.

Practical, scientifically based work in Bulgaria (Petrov 1994) is orientated towards:

- elaboration of suitable methods for creation of plantations
- production of acorns and planting material
- pruning to form the stems and crowns, in order to produce cork.

Scientific study is focused on the following (Genov 1985, 1998):

- male and female reproductive organs morphogenesis
- biology of fruit-bearing
- phenological diversity and opportunities for genetic exchange between simple phenoforms and growth particularities of the varieties in the seed stand in Dervishitsa.

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France

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Introduction

As reported previously (Lumaret 2000), except in a few cork oak local areas (mostly located in Provence), no particular *in situ* conservation strategies are needed for the three evergreen Mediterranean oak species growing in France (i.e. *Quercus ilex*, *Quercus suber* and *Q. coccifera*) as well as for *Q. pubescens* which also grows in the French Mediterranean area but which extends substantially in more northern regions of the country (see Schirone and Spada 2000 for remarks about the definition of Mediterranean oaks). However, except for *Q. coccifera*, a minor species with no economic importance and considered a woody pest in several areas, up to now, Mediterranean oak seeds commercialized for afforestation purposes were collected in uncontrolled areas. To comply with the European legislation (1999/105/CE), the delimitation of French provenance regions was needed for several oak species of the Mediterranean area, namely *Q. ilex* (Holm oak), *Q. suber* (Cork oak) and *Q. pubescens* (Pubescent oak). The Centre de Machinisme Agricol du Génie Rural et Forestier (CEMAGREF) and, more particularly, Christelle Rousselet in the Research Unit 'Ressources Génétiques et Plants Forestiers' in Nogent-sur-Vernisson (France) was in charge of this task and a provisory document was established in 2001. In the present report, the method used to establish the limits of the provenance regions, the provisory results obtained up to now and suggestions to improve them in the future are presented.

General method used to establish oak provenance regions in France

The method was the same as that used for any important forest species (either broadleaf species or conifers) growing in the country. The general characteristics of the species are summarized. More particularly the species distribution and frequency is assessed (m^3/km^2) in each of the several hundred ecological units identified in France according to the National Forest Inventory (Inventaire Forestier National, IFN) established by national institutions (e.g. Office National des Forêts, ONF). Additional information about the main climate and edaphic requirement of the species is indicated.

For each species, the provenance regions correspond to the main distribution areas and their delimitation is based on a combination of genetic variation for adaptive traits (e.g. leaf morphology related to climate characteristics) and for neutral characters (more particularly allozymes and chloroplast DNA) which are able to reveal the population relationships and the phylogeographic variation related to the several routes used by the species after the glaciations to colonize French areas (see Petit *et al.* 2002 for European white oaks). The maps are updated regularly according to further genetic information provided by scientific groups from the results of their analyses.

Results

Delimitation of provenance regions

Cork oak (*Q. suber*)

In France, the species is distributed in four geographically distinct regions—Corsica, Provence, French Catalogna and Landes (along the Atlantic Ocean)—which were considered as distinct provenance regions on the basis of climate characteristics. However, on the basis of allozyme variation, the two first regions were grouped with other populations from Italy and North Africa characterized by low genetic diversity whereas the populations from Landes and French Catalogna were clustered with the populations from Iberia and characterized by higher genetic diversity with specific additional alleles (Toumi and Lumaret 1998). These results were used in the recommendation protocol for cork oak use. When sufficient cork oak seed material is not available in the original region, it may be collected in the other region of the same group. Information from cpDNA variation begins to be available and indicates that cork oak populations from French Catalogna are entirely derived from hybridization with holm oak (*Q. ilex*) as all the numerous trees analysed possess cpDNA molecules characteristic of the holm oak phylum, whereas cork oak populations from Corsica and Provence are very slightly introgressed by the holm oak genome. When completely available, information based on cpDNA variation will be used to improve the delimitation of cork oak provenance regions.

Holm oak (*Q. ilex*)

The species is mostly distributed in the Mediterranean border, from French Catalogna to Provence, in Corsica, and along the Rhône valley. Along the Atlantic border, the species grows from Arcachon (Landes) to the south of Brittany. As reported previously (Lumaret 2000), three groups of populations were distinguished on the basis of morphology (ilex and rotundifolia morphs or intermediate morphology), allozyme and cpDNA variation, which correspond to the regions of Corsica + Provence, Languedoc + French Catalogna + the western part of the Rhône valley + populations from the southwest, and the Atlantic populations, respectively. However, at present, four regions of provenance are distinguished with identification of a specific region in the southwest. Further genetic analyses are needed to put this distinction to the test. Recent results from cpDNA analyses (Lumaret *et al.* 2002) suggest that more precise delimitation may be established in the near future.

Pubescent oak (*Q. pubescens*)

Four regions of provenance were distinguished, namely the southwest of France, Languedoc, Provence and Corsica, mostly on the basis of the chloroplast DNA variation analysed by Petit *et al.* (2002). However, partial discrepancy is observed between the limits of the provenance regions and the chlorotype geographical distributions, more particularly in Provence, suggesting that further genetic analyses are needed to improve the delimitation. In the recommendation section of the document, the use of seed material from Provence in case of lack of material from Languedoc needs to be clarified because each region is characterized by a distinct chlorotype.

Identification of selected stands for acorn collection

As was reported for Spain by Jimenez and Gil (2000), for each Mediterranean oak species and in each provenance region, a catalogue of selected stands is established progressively and will be periodically updated. For instance, in the region of Languedoc and in French Catalogna, the Regional Direction of Agriculture and Forestry (DRAF) of Languedoc-Roussillon is in charge of providing and updating lists of collecting sites for the three main oak species growing in that region. For several of these sites, the plant population genetics group of CEFE (CNRS-Montpellier) was asked to provide information based on morphology (more particularly to identify interspecific hybrids and morphologically intermediate individuals) and on the variation of several types of diagnostic genetic markers. Oak species were identified primarily on the basis of morphology and, when possible, contact areas between several oak species were excluded from the selection in order to maintain the specific characteristics of the reproductive material. However, the genetic variation recovered (or captured!) from natural interspecific introgression over large areas and during long periods was considered part of the whole genetic variation which characterizes each species and was used to identify regional genetic variation.

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Italy

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Introduction

Italy is probably the European country where the highest number of *Quercus* species live. According to Pignatti (1982), up to 15 species and several varieties are present in our territory, even if, as a common opinion, some of them could be re-classified as subspecies or morphotypes, following an exhaustive genotypic analysis.

However, seven oak species are well characterized and clearly distinguishable among the others: they are those to be fully addressed as Mediterranean Oaks (Schirone and Spada 2000): *Quercus ilex, Q. coccifera, Q. cerris, Q. trojana, Q. macrolepis, Q. suber* L. and *Q. frainetto*. The list may include also *Q. pubescens*, for which the definition of 'Mediterranean' holds true, at least in some intraspecific taxa.

Unfortunately, a clear picture of the entity and distribution of the species is not yet available for most of the Italian oaks, even though some of them undoubtedly are of some economic interest. The National Forest Inventory, completed in 1985 and actually undergoing updating, has been done only on a sampling basis. More detailed field investigations are the responsibility of the regional bureau but, up to now, only small portions of the territory have been studied.

The following is a brief summary of the available data for the above-listed Mediterranean oak species in Italy. The area occupied by each species and relative distributions are presented in Figure 1.

Quercus suber L.

At present, *Q. suber* (cork oak, *sughera* in Italian) covers an area of around 90 000 ha, mainly along the Tyrrhenian coast. The species is relatively rare in Liguria; more frequent in Tuscany and Latium, also in the inner part of the regions; relatively rare in Campania, mostly for anthropogenic reasons; particularly diffuse in Calabria, with stands along the Ionian coast, also; absent along the Adriatic coast, except in Apulia where there are small stands all situated in Brindisi province. Cork oak is present in central Sicily and rather widespread in Sardinia, the Italian region with the widest distribution of the species (nearly 90% of the total surface in Italy). In Basilicata (southern Italy), the most inner stand of the southern Apennines was found. Just as in other European countries, the surface covered by the species is rapidly and progressively decreasing in time, mainly due to human activities connected with grazing, farming, indiscriminate extraction of cork and numerous fires. Actually, the interest of the Government authorities in cork oak is increasing and projects for the recovery of the species are beginning.

A precise determination of the real extent of the cork oak growing surface is hard to quantify and is still a matter of debate. In fact, there is not yet a unique definition for 'cork oak wood' and 'cork oak stand', from either a conceptual or a juridical point of view, with a special reference to the Sardinian situation, where cork oak is highly widespread but present under different population typologies. For instance, according to the Regional Cork Oak Inventory of Sardinia (1991), which used 25 trees/ha as a sufficient parameter for the definition of cork oak wood, the total area was 180 000 ha, including mixed woods with holm oak (*Q. ilex*) and pubescent oak (*Q. pubescens*). Larger areas (100 000–500 000 ha) belonged to the definition of maquis with cork oak and grazing lands with sparse cork oak trees.

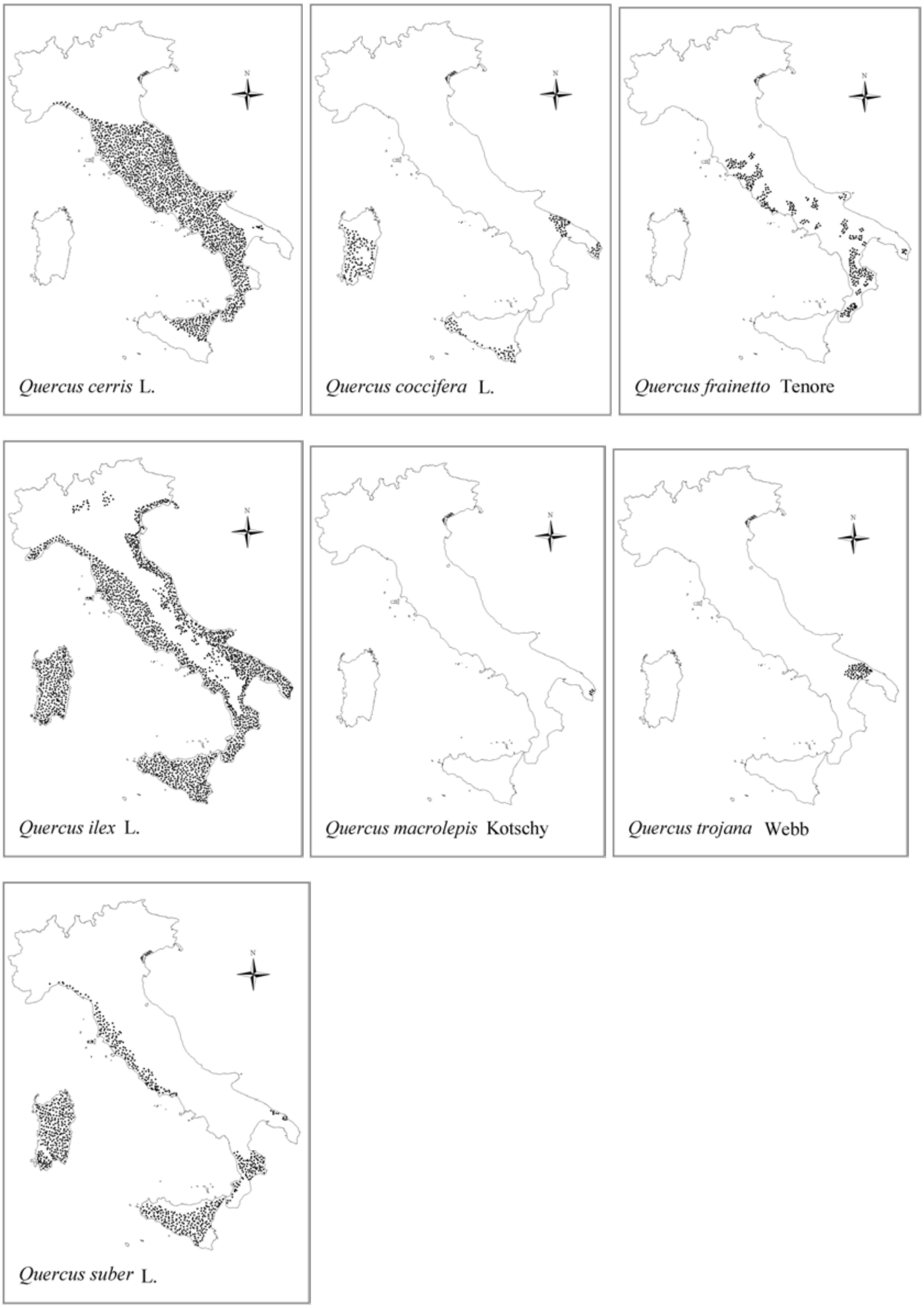

Figure 1. Mediterranean oak species distribution in Italy.

On the other hand, the National Institute of Statistics (ISTAT) estimated in 1997 a total amount of 106 073 ha on the national territory, with 89 209 ha in Sardinia, 6008 ha in Sicily, 1526 ha in Calabria, 1246 ha in Tuscany, 1149 ha in Latium, 258 ha in Campania, 251 ha in Apulia and 6 ha in Liguria. The most recent data for Sardinia (National Forestry Service, 1998) are still contradictory, giving 122 954 ha exclusively referring to forests with prevalence of cork oak and including grazing areas with a minimum of 10% cork oak tree coverage.

Grazing areas with sparse cork oak trees are particularly hard to classify, as the peculiar utilization of the land does not allow a proper 'wood' definition but, nevertheless, the cork production (q/ha) of these usually adult and large trees is considerable. Moreover, mixed formations (with other oak species) also present some difficulties for evaluation of the entity of the cork oak stands, as well as the very small stands (few square meters) that are effectively managed as if they were woods. The accuracy of such definitions is of extreme relevance, in order to precisely evaluate the extent of the land with high potential for cork oak culture.

In fact, cores and isolated cork oak trees may indicate the existence of favourable conditions for expanding the culture and linked activities, and may also provide useful information on the ecological needs for cork oak to be planted outside its natural distribution area.

Sardinia is the top producer of cork in Italy (95 000–160 000 q/yr, ISTAT 1997). Its raw material is high quality but the amount produced is too low to fulfill the transforming capacity of Sardinian factories, so that they are forced to use a large amount of imported material. This gap between the amount produced and the transformable capacity has been used by Sardinian farmers to stimulate the local and national administration to sustain and even increase the actual cork oak culture.

A contribution on some genetic aspects of *Q. suber* and the conservation strategies developed in our laboratories in Viterbo is presented by Bellarosa *et al.* (this volume).

***Quercus ilex* L.**

Quercus ilex (holm oak, *leccio* in Italian) stands cover 370 000 ha in Italy, all along the peninsula except in the Alps and Padana Plain. Some isolated stands, however, can be found around the big pre-Alpine lakes (the so-called 'Insubria' region), where the climatic conditions become milder.

The species is generally well understood, though recently under a progressive revision of its ecological characteristics. In fact, *Q. ilex* was previously considered more xerophytic than it really is. The species is the least drought resistant of the evergreen Mediterranean oaks (*Q. ilex*, *Q. suber* and *Q. coccifera*) and, if the climatic conditions are suitable, it can even reach high altitudes in the Central Apennines where good levels of humidity can be found, and form mixed populations with beech and silver fir.

Intensive uses are those based on firewood; Tuscanian and Sardinian productions are commonly exported, even to North Africa.

Even though it is widely distributed, at the moment only a few genetic studies have been conducted and limited knowledge about its genetic structure is available (Bellarosa *et al.* 1990; Toumi and Lumaret 2001; Lumaret *et al.* 2002).

***Quercus cerris* L.**

The species (Turkey oak, *cerro* in Italian) covers a very large area (280 000 ha) all over the Italian peninsula. Sporadic and probably introduced in the Padana Plain, it becomes more frequent towards Tuscany and southward. The species is very diffuse in south Abruzzo, Molise, Gargano (Apulia), in Basilicata and Campania but rare in Sicily and absent in Sardinia. *Q. cerris* prevails in the range between the sub-Mediterranean level and 800 m asl but can reach 1200 m on sunny slopes.

The species ecology has been studied in depth but its role in the vegetation dynamics is not yet completely understood. Turkey oak is characterized by a mesophilous-subcontinental behavior: it is fairly resistant to cold and high thermal extremes and is moderately tolerant of summer drought (less than *Q. pubescens*). The species is heliophilous and prefers basic, deep and fresh soils. Some ongoing dendro-ecological studies in our laboratory appear of great relevance. Indeed, *Q. cerris* shows a high adaptability to environmental factors, greater than what was previously assumed. In fact, when growing at high altitudes, individuals of *Q. cerris* may appear more similar to common beech than to individuals of the same species grown in the plains.

Its wood has no valuable technological properties. The species was the object of great interest many years ago, owing to the use of its wood for railway crossties and for this reason ca. 70 000 ha were managed as high forest. Now, the interest has declined and the forests are just coppiced for firewood. Nevertheless, some wood industries experimentally produced encouraging results for possible utilization as parquet and plywood production.

The embryology of *Q. cerris*, particularly the development of the female gametophyte, has been investigated in detail by Ciampi and Bianco (1977). However, little is known about the genetic structure of the species. Giordano and Schirone (1989) and Bellarosa *et al.* (1990, 1996) found large levels of individual genetic variability and a notable phenotypic plasticity.

Hybridization with *Q. suber* gives origin to fertile hybrids (*Q. crenata*, Bellarosa *et al.* 1996) and there is also some evidence of hybridization with *Q. macrolepis* and *Q. frainetto* (Schirone and Piovesan 1998).

Quercus frainetto Ten.

In Italy, *Quercus frainetto* (Hungarian oak, *farnetto* in Italian) stands cover 40 000 ha. The bulk of the species distribution is in the southern regions whereas in the central areas of the Peninsula it reaches outposts scattered along the pre-apenninic ridges, mostly over the Thyrrenian side; it is absent in the islands. Long-term human disturbance of the vegetation in peninsular Italy has largely affected the *Q. frainetto* range, which is spatially coincident with most of the historical agricultural areas. Present-day discontinuity in the distribution area of the species is therefore mainly anthropogenic. This results mostly from the high-demanding ecological characteristics of the species: it is basically thermophyllous, with a moderate climatic range, and requires appropriate atmospheric humidity, good lighting (it does not endure overshadowing) and fertile, preferentially alluvial silica soils. In fact, the Italian stations where it can be found are generally characterized by rainfall exceeding 900 mm/yr, reduced and short summer drought, temperatures in the coldest winter month in the range of 0–5°C and deep, pedologically evolved soils. Though valuable for handicrafts (in many ways, the quality of its wood is comparable with that of sessile oak, to such a point that sometimes it is even fraudulently commercialized instead of it), its wood is mainly used for fire.

Q. frainetto is not put under any protection and also studies on its biology and ecology are few.

Fineschi *et al.* (pers. comm.) started some genetic investigation, and for several years our research group has been involved in evaluating its distribution, ecology and silviculture. These are of much interest nowadays because of the further increasing reduction of its area by human activity (fires and poor land management).

In fact, *Q. frainetto* usually grows in mixed stands with *Q. cerris* and vegetates on more fertile microsites, being more demanding than the latter; owing to its good resprouting attitude, a coppice system has been used for a long time. Our investigations showed that after a faster initial growth the latter overtakes and suffocates it. Many losses in the distribution of the species (as shown by forest archives) and even the loss of entire stands, mainly along the Adriatic side, can be explained by this way of forest management. In contrast, *Q. frainetto* grows well with a high forest system which would be a good measure for species protection.

Quercus trojana Webb.

Q. trojana (Macedonian oak, *fragno* in Italian) grows only in Apulia, in a well-circumscribed area of about 13 000 ha, corresponding to the low calcareous hills named Southeastern Murge. The local ecology of the species has been assessed in several documented studies. It vegetates on a territory with favourable thermal (mean temperature = 16°C, minimum = 6°C, maximum thermal range = 17°C) and pluviometric (700 mm/yr) conditions. The soils are rich (brown and red soils, rendzines) as well.

Macedonian oak forests live on a higher belt than holm oak, with Turkey oak forests at their higher levels. *Q. trojana* frequently forms pure stands but more often it associates with *Q. pubescens*, even if more thermophyllous and less drought-tolerant than the latter. *Q. trojana* also has good resistance to strong winds.

The presence of Macedonian oak in Apulia can be interpreted as the result of a progressive withdrawal of the species during the last Ice Age, from a certainly wider range (Schirone and Spada 1995). Then, the new favourable post-glacial climatic conditions coincided with the increase in farming activities, still existing today. Less than one century ago, *Q. trojana* occupied 20 000 ha, with some stands in Basilicata and in the far northern side of the Murge hills. Another reason to explain the decrease of the species range can be found in the good technological properties of its wood for shipbuilding, to such a point that the Ancient Republic of Venice owned large forests of *Q. trojana* in Apulia, specifically devoted to this use. Today, more than half the stands are managed as coppice for firewood. The remainder constitutes the so-called 'forest-parks', woods made of large and sparse trees to allow acorn grazing. *Q. trojana* is not under any form of protection, even if the local administration promotes its planting and recommends future conservation.

The levels of knowledge achieved on the embryology of the species are very detailed (Bianco 1961) and preliminary data on its genetic structure have been inspected (D'Emerico *et al.* 1995; Bellarosa *et al.* 1990, 1996, this volume). It may be interesting to point out that in an area surrounding Bari (Apulia) there was recently identified an individual of *Q.* × *schneideri*, derived from the hybridization between *Q. trojana* and *Q. cerris*. The sample is currently under investigation in our lab.

Quercus coccifera L.

Q. coccifera (Kermes oak, holly oak, *quercia spinosa* in Italian) grows in Apulia, Sicily and Sardinia. Its distribution in Apulia is well documented, while only imprecise and generic information characterizes the available data on Sicily and Sardinia. Moreover, pure stands are formed only rarely, and never larger than a few thousand square meters. Thus, only rough estimates (10 000–20 000 ha) can be formulated about the real extent of the species.

Q. coccifera usually colonizes degraded soils or represents degraded stages of *Q. ilex* stands. In fact, it is ubiquitous with respect to the soil chemistry and shows greater resistance to drought and thermal extremes than holm oak. Its heliophylly is relevant, unlike *Q. ilex* which is characterized by sciophyllous attitudes in its younger stages. Finally, its greater adaptability can be seen in its reproductive biology, which allows optimal utilization of the water resources (Bianco and Schirone 1985). No particular utilization of the wood is known and the species is not under any form of protection.

In Italy, *Q. coccifera* is present with two subspecies (or varieties): *Q. coccifera* subsp. *coccifera*, diffuse in Sicily and Sardinia, and *Q. coccifera* subsp. *calliprinos* prevailing in Apulia. The first data on its genetic constitution have been assessed only for the Apulian stands and for a single population from Sardinia (Bellarosa *et al.* 1990, 1996; Toumi and Lumaret *et al.* 2001).

Quercus macrolepis Kotschky

In Italy, the species (Valonia oak, *vallonea* in Italian) grows only in far southern Apulia on an area of about 10 ha, characterized by high rainfall (>800 mm/yr) and mild temperatures even in winter (January isotherm = 7.5°C).

It was maintained in the past that the species could not be spontaneous in Apulia but was introduced for the use of the cupule of the acorn as raw material for tanning. This hypothesis is contradicted by several historical and phytogeographical considerations and, above all, by the recovery of old fossil remnants in Tuscany, dating back to Riss-Wüerm. Therefore, we maintain the presence of *Q. macrolepis* in Apulia can be explained with the same rationale as for *Q. trojana* (see above).

At the moment, we do not know any particular use either for its wood or for the species itself.

It is under local administration protection and its propagation is safeguarded too. A germplasm conservation programme has not been developed yet. Its ecology and reproductive biology are well known (Scaramuzzi 1960) and the first studies of its genetic constitution have begun and are currently under completion in our laboratories (Bellarosa *et al.* 1990; Bellarosa *et al.* this volume).

Conclusions

All oak taxa present in Italy, except *Q. crenata,* grow in Middle-South Apulia, the most southeastern region of Italy. Two species (*Q. trojana* and *Q. macrolepis*) are only found here. Apulia is also one of the richest areas in oak species of the Mediterranean Basin (Figure 2). Moreover, the region constitutes the westernmost distribution area of *Q. trojana* and *Q. macrolepis*, as well as the easternmost, relative to *Q. suber*.

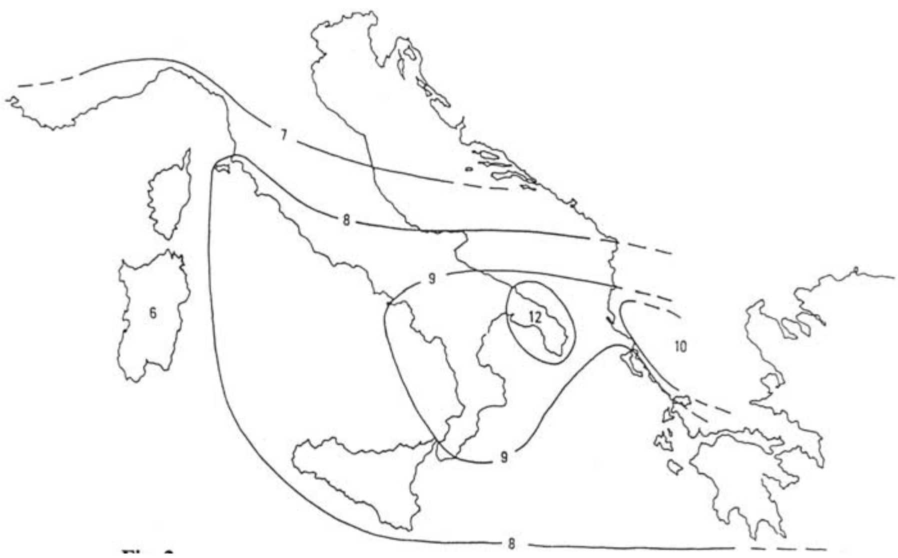

Figure 2. Patterns of isopories labelling South Apulia as the richest area of *Quercus* species among the surrounding territories. Relative amount of taxa are indicated (from Schirone and Spada 1995).

The Apulian landscape, which escaped the climatic worsening linked to the last glaciations, now is highly influenced by large, intensive and particularly old farming. In fact, several of Italy's most ancient paleolithic and neolithic settlings are located in Apulia.

Therefore, there are two reasons why this region is so important, owing to the contemporary presence of all Italian oaks: (1) from a phytogeographic point of view, as a refugial area for most of the European mesothermophilic vegetation during the last ice age it represents a large pool of biodiversity and an interesting field for multidisciplinary analyses as well; (2) from a political and management point of view, it is an area of quite limited extent (about 8 500 km²) with natural borders (three sea limits), under a single local administration.

For all these reasons it could be ideal as a 'park' for oak germplasm conservation, right in the middle of the Mediterranean Sea. Our efforts in the near future will thus be aimed at developing a comprehensive research project for reaching this important scientific and political objective.

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Macedonia FYR

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Introduction

Despite their broad distribution, the Mediterranean oaks in the Republic of Macedonia (except *Q. macedonica*) are not yet covered by any conservation or improvement programs. Within the long-term state strategy for protection and improvement of economically important forest tree species, it is foreseen that *in situ* measures will be taken only for the conservation of *Q. pubescens* and *Q. frainetto.*

Conservation and use

There are still no *ex situ* conservation measures being taken for these species in Macedonia.

In the current programme for protection and improvement of economically important forest tree species, two seed stands of *Q. macedonica* in west Macedonia, which are part of the National Park 'Galitchica'-Ohrid, have been selected. At Trpejca-Ohrid, the seed stand covers 5.0 ha; at Leskoec-Prespa, it covers 3.0 ha.

Changes in inventories

The update of the inventories (distribution, management practices and timber volume) of some Mediterranean oaks is given in the state forest enterprise management plans every 10 years.

Changes in relevant policies and legislation

Within the new Law on Forests (1997), tree seed stands and seed orchards have been defined as areas for special use and therefore are protected. The protection also specifies that *in situ* measures should be taken.

Changes in research

In the EU-FAIR Oak project the vegetative material (leaves and buds) of *Q. macedonica*, *Q. pubescens*, *Q. coccifera*, *Q. frainetto* and *Q. cerris* was collected and sent to the laboratory in France for further analyses and a study of genetic variation of these species using chloroplast DNA markers. This is the first time that any of the oak species within the territory of the Republic of Macedonia are being studied using DNA markers.

Changes in country priorities

The lack of genetic knowledge is recognized as a major limitation for gene conservation of the Mediterranean oaks in the Republic of Macedonia. There should be research carried out to assess the within- and among-population genetic variability using DNA markers along with provenance and progeny trials. Unfortunately, owing to lack of equipment and financial resources, such analyses cannot be presently carried out.

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Malta

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Conservation and use

In situ

In January 2001 *Quercus ilex* was protected as a species under Legal Notice 12,2001. The same legal notice also protected the habitat by declaring all the natural populations of *Q. ilex* as Nature Reserves.

The government is currently updating its legislation (Environment Protection Act) in order to make it compliant with Habitats Directive regulation 92/43/EEC. A list of protected areas was prepared as part of the Common Database on Designated Areas by the Biodiversity unit of the Environment Protection Department. This includes all protected woodlands or groups of trees in the Maltese islands including the four natural oak populations.

Ex situ

There are currently no *ex situ* conservation measures for Mediterranean Oaks in Malta.

Changes in inventories

There are no inventoried trees as such, but there are a number of conservation programmesin the pipeline, e.g. the 'remarkable tree' project, biodiversity action plans, and habitat inventorying programs.

Changes in relevant policies and legislation

Apart from the legislation mentioned under *in situ* conservation as well as the amendments for the Habitats Directive, there are plans to modify the Trees and Woodlands Protection Regulation to drastically increase the punitive fines.

Changes in research

Several samples of leaves of *Q. ilex* were sent separately to Roselyne Lumaret of the Centre Louis Emberger in 2000, Luis Gil of the Universidad Politecnica De Madrid in 2002, and Giuseppe Vendramin of the Istituto di Genetica Vegetale in 2003, for genetic analysis by Eman Calleja.

Acknowledgement

Some of the information was kindly provided by Mr Darrin Stevens of the Biodiversity Unit, within the Environment Protection Department.

Slovenia

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In Slovenia there are seven native oak species: *Quercus robur* L., *Quercus petraea* Liebl., *Quercus cerris* L., *Quercus pubescens* Willd., *Quercus ilex* L., *Quercus crenata* Lam. and *Quercus virgiliana* Ten.

Although *Q. robur* and *Q. petraea*, the two most common Slovenian oak species, are sporadically present on good soils in the Mediterranean part of Slovenia, they are not included in this report. According to some authors *Q. virgiliana* is also native in Slovenia, but so far the presence of this species is not fully confirmed and therefore doubtful. Its taxonomic status is also not completely clear. For this reason this species is also not included in this report which focuses on the following four species: *Q. cerris*, *Q. pubescens*, *Q. ilex* and *Q. crenata*.

Quercus cerris (Turkey oak)

Turkey oak is relatively widely distributed in Slovenia (Figure 1). It is most frequent in the submediterranean regions of Kras, Brkini and Tolminsko, but it also grows on warm and dry steep slopes in the continental parts of Slovenia. In Dolenjska, Suha krajina and Bela krajina it associates with *Ostrya carpinifolia*, *Q. pubescens* and sometimes *Fagus sylvatica* on dry southern slopes which used to be heavily cut in the past. In Štajerska and Prekmurje it grows together with *Castanea sativa* on sites, affected by summer drought. Small groups can also be found in other parts of Slovenia such as Gorenjska. It is usually distributed in the range between 400 and 600 m altitude growing on sites with deep or degraded and dry soil. It slightly prefers siliceous parent rock. It is light demanding, and resistant to strong winds and to some extent to air pollution. Its silvicultural and ecological characteristics are between those of *Q. pubescens* and *Q. petraea*; it occupies areas too cold for *Q. pubescens* and too dry for *Q. petraea*. In good soil it can grow to BHD 160 cm and a height of 20 m.

Compared with potential vegetation its share is significantly increased on poor, dry sites that have been degraded as a result of centuries of overuse and cattle grazing, where other oak species can not grow. Here its protective and meliorative roles are very important. Its growing stock is 1.77 million m^3 which represents 9.9% of all natural oaks growing stock in Slovenia. Its economic importance is small because the wood is produced in small quantities and is less valuable in comparison with other oaks. Most of it is used as firewood, recently also for timber production. A significant share of *Q. cerris* forests in Slovenia are coppice stands but in recent decades they have been transformed into high-stem stands.

In the last decade some research on taxonomy and morphological variation was carried out, but no research on genetic variation of *Q. cerris*.

There are two seed stands of *Q. cerris* in Slovenia. We estimate that the share of *Q. cerris* in the total growing stock (0.76%) will not change substantially in the future because it will keep its important role on some poor sites. We can conclude that *Q. cerris* genetic resources in Slovenia are not threatened.

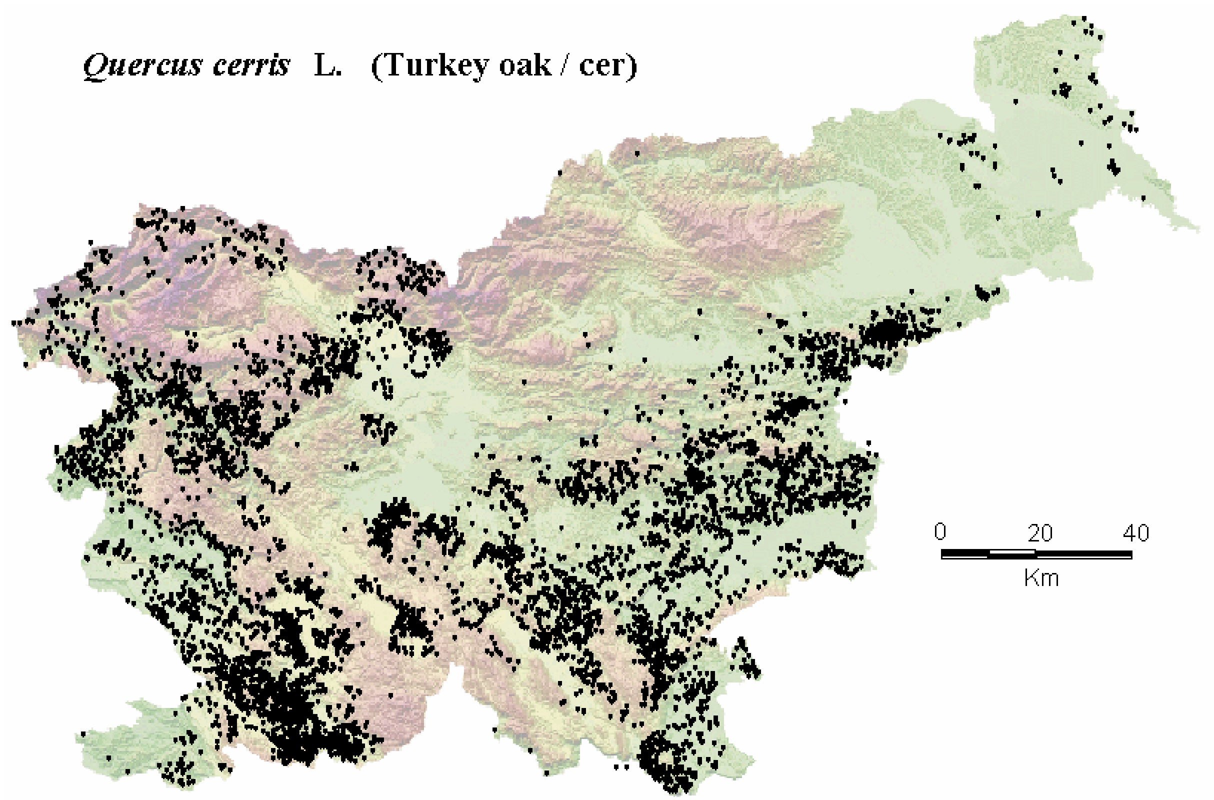

Figure 1. Distribution and average growing stock of *Quercus cerris* in Slovenia.
Source of data: Slovenian Forest Service; updated: 31.12.1999 - Prepared by: Sašo Žitnik, MSc., Slovenian Forestry Institute, for EUFORGEN/IPGRI, 2001
Note: Data is shown for units (point = centroid of the unit) in which the species was registered (the GS was above 1% of unit GS).

Quercus pubescens (Pubescent oak)

Continuous stands of pubescent oak are concentrated mainly in the Mediterranean and submediterranean regions (Figure 2) in associations of *Quercetalia pubescentis* type, where it associates with a number of thermophyllous species such as *Fraxinus ornus*, *O. carpinifolia*, *Carpinus orientalis*, *Quercus cerris*, *Prunus mahaleb*, *Acer monspessulanum*, *Cotinus coggygria*, *Amelanchier ovalis*, *Cornus mas* and others. In smaller populations it is also present in continental parts of Slovenia, as a rule on warm southern slopes of hills and mountains up to 1000 m altitude. Such examples are Slivnica, Polhograjska Grmada and some smaller hills but also Konjiška gora, Bohor, Kum, Pogorje and Bela krajina. It grows on poor, dry and often eroded or degraded sites in the Mediterranean phytogeographic region, on both calcareous and siliceous sites, while in continental Slovenia it mostly grows on calcareous sites. On the best sites it can reach a height of 20 m and BHD of 130 cm, on the poorest sites it is sometimes bushy.

Its present growing stock is 0.35 million m^3 which represents only 2% of all oak growing stock in Slovenia. Its economic importance is small because wood is produced in small quantities. Its ecological role is more important, especially on highly vulnerable calcareous steep slopes that it protects.

In recent years research on taxonomy and morphological variation as well as genetic variation of *Q. pubescens* has been done.

We estimate that the *Q. pubescens* share in the total growing stock (0.15%) will increase slightly in the future owing to natural succession on once highly degraded calcareous sites in Kras. The genetic resources of the species are not threatened in Slovenia.

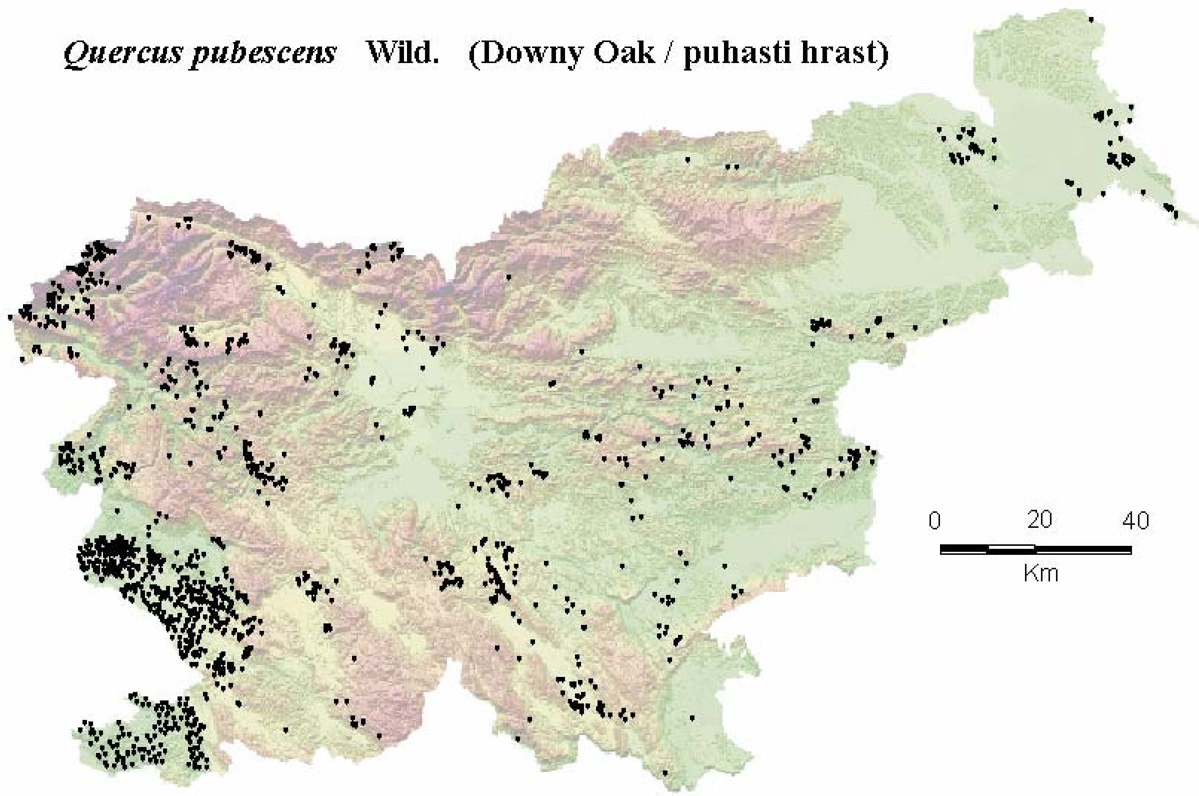

Figure 2. Distribution and average growing stock of *Quercus pubescens* in Slovenia.
Source of data: Slovenian Forest Service; updated: 31.12.1999 - Prepared by: Sašo Žitnik, MSc., Slovenian Forestry Institute, for EUFORGEN/IPGRI, 2001
Note: Data is shown for units (point = centroid of the unit) in which the species was registered (the GS was above 1% of unit GS). © Slovenian Forest Service & Slovenian Forestry Institute 2001

Quercus ilex (Holm oak)

In Slovenia the population of *Q. ilex* is very fragmented because the species is on its geographical borderline. There are no continuous stands of this species because parent rock on the Slovenian coast is mainly relatively cold and wet flysch. In the Mediterranean region in Slovenia only single trees, small groups or in some cases small stands can be found on steep, warm and protected southern sites on limestone. It is a dominating species in the patches of evergreen eumediterranean vegetation of relict character belonging to a more or less impoverished form of the association Orno-Quercetum ilicis. In the warmer areas closer to the coast (Stena and Sv. Štefan along the Dragonja river, steep rocky walls along Črni Kal and Osp) it associates with *Pistacia terebinthus, Phillyrea latifolia, Rosa sempervirens, Paliurus spina-christti, Celtis australis, Osyris alba, Lonicera etrusca, Laurus nobilis, Smilax aspera, Asparagus acutifolius* and *Ruscus aculeatus*, while at Sv. Nikolaj, at the foot of the Nanos mountain, only the last two Mediterranean species can be found. In this stand *Q. ilex* also associates with *O. carpinifolia*, *F. ornus*, *Corylus avellana*, *A. monspessulanum* and *Q. pubescens*. Single *Q. ilex* trees or small groups also grow along steep rocky slopes above the Vipava Valley.

Quercus ilex stands or trees are not commercially used in Slovenia. They are more important because of their landscape attraction and scientific value, in particular for growing on its geographical borderline with limiting climate conditions. Even if they grow on remote sites with difficult access and adapted management, fragmented populations are vulnerable to extinction and losses of genetic variation. Therefore, *Q. ilex* is marked as an endangered species in terms of IUCN categories in the Red Data Book.

Quercus crenata

Even if the taxonomic status of *Q. crenata* is considered different, in this report we treat it as a separate species. It belongs among the rarest tree species in Slovenia. Today only some single trees in the submediterranean region of Kras grow naturally in Slovenia. The first known specimen of *Q. crenata* in Slovenia was found near the river Reka in Brkini in 1892. In the years that followed some more were found; however the last one died some 15 years ago. The species was thought to be extinct in Slovenia until 1996 when some trees were found in Kras. They associate with tree species such as *Q. cerris, O. carpinifolia, F. ornus, Q. pubescens, Q. petraea, P. mahaleb* and others. All trees are found between 300 and 550 m altitude, on relatively deep and fresh soil, on carbonate parent rock.

The question is whether *Q. crenata* is native or planted in Slovenia. The fact that trees have been found regularly for over 100 years speaks in favour of 'native'. Besides, all known trees grow in a relatively small geographic area, in similar ecological conditions, and they fructificate, although not regularly.

Q. crenata is important in Slovenia as a botanical rarity. The reason for its scientific value is that it grows on its geographical borderline with limiting climate conditions. It is definitely one of the most highly endangered species in Slovenia; in the Red Data Book *Q. crenata* is marked as an endangered species in terms of IUCN categories.

Suggestions on how to improve the conservation of the Mediterranean oak genetic resources in Slovenia

For *Q. cerris* and *Q. pubescens* no particular conservation strategies are needed. The regime of their management, based on natural regeneration already included in forest management plans and detailed silvicultural plans, assures the continuity and sufficient conservation of their genetic resources. In areas with regeneration problems appropriate planting material from selected seed stands should be used. For this purpose some more seed stands of both *Q. pubescens* and *Q. cerris* will have to be selected. Studies of the genetic variation of both species as well as more detailed taxonomic studies of the *Q. pubescens* s.l. complex to clarify the presence and status of *Q. virgiliana* also are needed.

Some of the most typical stands of *Q. ilex* certainly deserve to be protected by appropriate conservation regimes as soon as possible; in all other stands, special adapted management should be implemented. All trees of *Q. crenata* (or even better their sites) should be protected immediately. Moreover, planting seeds raised from local sources on natural sites should be considered. At least some basic research on genetic variation of both species is needed.

The new Act on Forest Reproductive Material which will enter the parliamentary procedure in June 2002 also will be important in preserving the genetic resources of all four species.

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Turkey

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Introduction

The second most important forest tree for Turkey is oak, which has more than 200 species in the world. There are 18 species in Turkey. Their taxonomic position is not clear yet, especially for *Q. infectoria, Q. pubescens* and *Q. cerris*. These taxa are very variable in morphological characters and in their interactions with each other, although *Q. vulcanica* and *Q. petraea* are very similar in morphology. All these species need detailed studies.

The oaks of Turkey can be grouped according to their wood type, maturation period of fruits and their leaves and barks as follows: White oaks, Red oaks, Evergreen oaks.

- White oaks (Section: *Quercus*) are *Q. robur, Q. petraea, Q. hartwissiana, Q. frainetto, Q. vulcanica, Q. pontica, Q. infectoria, Q. pubescens, Q. macranthera* subsp. *syspirensis* and *Q. virgiliana*.
- Red Oaks (Section: *Cerris*) are *Q. libani, Q. trojana, Q. cerris, Q. brantii* and *Q. itheburensis* subsp. *macrolepis*.
- Evergreen oaks (Section: *Ilex*) are *Q. coccifera, Q. ilex* and *Q. aucheri.*

These species can grow in all kinds of soil types and climatic condition. Most of them—especially Mediterranean oaks—are also resistant to drought, poor soil conditions and can grow on eroded rocks. They rarely form pure stands. Most are secondary trees in mixed stands or understorey shrubs in coniferous forests and pure or mixed in maquis areas.

Conservation and use

There are different approaches for conservation of plant genetic resources, but protecting species and their genes can be done best through protecting them within their natural habitats, and eventually in ecosystems where they live with other species. *In situ* conservation is considered the best solution to conserve plant genetic resources.

This kind of study has been done for a long time in Turkey. Oak species have been conserved by *in situ* methods with different names such as national parks, seed stands and gene conservation forests, etc. To date, 16 seed stands and 10 gene conservation forests have been determined for different oak species (Tables 1, 2). The total seed stand area is 1627.1 ha, of which the core area is 896.16 ha. The total Gene Conservation Forest area is 1266.6 ha, of which the core area is 367.2 ha. In addition there is a 1300-ha Nature Conservation Area for *Q. vulcanica*, which is an endemic and endangered species in Turkey. *Ex situ* conservation studies have been done by some institutions, but these studies do not include all oak species and the whole of Turkey.

For *Q. aucheri,* which is an endemic species in Turkey, there is no conservation programme. In Davis 1982 (Flora of Turkey and East Aegean Islands, Volume 7) *Q. aucheri* was recorded for C1, C2 and C3 squares which are in the southwest part of Turkey. In this area the species has a scattered expansion due to fragmentation of its area. *Q. aucheri* acorns have been collected by local people for food because they are sweet and edible. In addition, *Q. aucheri* areas are mostly maquis and degraded areas. The ground is very sloped and the soil is very poor. Climatic conditions are dry, and thus unsuitable for the growing of different vegetation types.

Table 1. Oak (*Quercus* spp.) seed stands in Turkey.

Province	Species	Area (ha)	Core area (ha)	Latitude	Longitude	Altitude (m asl)	Aspect	Age	Height (m)	Diam. (cm)
Adapazarı	sp.	38.00	11.50	403713	304658	550	S-E	89	27	42
Antalya	*cerris*	130.50	36.00	363130	321430	1100	SW	49	24	35
Bolu	*petraea*	57.50	20.00	405542	314041	1200	S-SW	120	20	42
Bolu	*petraea*	91.00	91.00	403725	305913	650	W	190	23	44
Bursa	*petraea*	112.50	43.50	394850	283445	150	NE-NW	120	34	34
Elazığ	sp.	195.00	140.00	390110	403235	1900	N-W	57	8	24
Elazığ	*libiani*	67.50	27.00	372458	423654	1650	N	150	20	38
Elazığ	sp.	332.00	266.00	391720	395230	2050	S-SW	80	8	35
Isparta	*vulcanica*	94.50	52.00	374444	304945	1500	E	160	21	32
Istanbul	*cerris*	44.00	3.00	414935	274117	450	S-SW	94	24	38
Istanbul	*petraea*	62.00	32.50	415614	274253	350	N	122	26	38
Istanbul	*cerris*	70.00	20.00	420312	270932	550	S	103	22	29
K.Maraş	*cerris*	80.50	30.00	373213	361548	10000	N	65	17	35
Kütahya	*cerris*	61.00	6.00	392807	294551	1300	N	43	8	13
Zonguldak	*petraea*	87.60	40.16	410453	314233	920	SE-S	158	28	46
Zonguldak	*petraea*	103.50	77.50	410253	322636	1320	S	90	25	43
Total		1627.10	896.16							

Table 2. Oak (*Quercus* sp.) gene conservation forest in Turkey

Province	Species	Area (ha)	Core area (ha)	Latitude	Longitude	Altitude (m asl)	Aspect	Age	Height (m)	Diam. (cm)
Bursa	*petraea*	140.50	10.00	395000	283530	500	N-NW	–	30	49
Adapazarı	sp.	150.00	13.50	403616	305202	–	All	–	–	–
Eskişehir	*vulcanica*	244.50	182.00	382852	371142	1700	NE	–	12	–
Balıkesir	sp.	120.50	47.00	394919	282500	610	E	143	24	38
Çanakkale	sp.	134.50	17.50	395400	271613	600	E	–	18	46
Isparta	*vulcanica*	92.50	16.00	374324	305015	1325	E	–	–	20
Antalya	sp.	99.50	13.00	370124	313300	950	SW	125	13	34
Sinop	*petraea*	142.00	33.70	415605	344620	90	NW	–	–	–
Zonguldak	sp.	49.10	10.50	410420	320330	600	SW	–	–	–
Bursa	*cerris*	93.50	24.00	395519	282644	300	SE	–	14	22
Total		1266.60	367.20							

In the Red Data Book on Plants of Turkey, *Q. aucheri* has been mentioned as “Lower risk (LW), but Conservation Dependent (cd)”. This means that in five years the species can take its place in the other risk categories if it is not conserved.

Studies on oaks

As oaks are very important for Turkey, many people are interested in them and different institutions have carried out different studies. Universities and research institutions are doing mostly basic studies such as taxonomic, ecological and genetic studies, but these studies are not enough or in cooperation between institutions.

Some non-governmental organizations (NGOs) have recently started some studies on oaks. One of them is important for Turkey, which is the "10 billion Oak Acorn Seeding", carried out by TEMA (Turkey Combating Erosion and Conserving Natural Resources Foundation), AGM (Reforestation General Directorate) and OGM (Forest General Directorate). The Foundation started a campaign for this study and has collected grant funds for the establishment of oak forests and rehabilitation of oak stands and coppices. Another NGO (GEMA, Gediz Combating Erosion and Conserving Natural Resources Foundation) is interested in Valonia oak (*Quercus macrolepis* Kotschky). A panel was convened by the leadership of GEMA, in which different subjects about Valonia oak were discussed; people who joined the panel decided that Valonia oak is very important for Turkey and should be conserved with the participation of local people.

In 2001, Ege Forest Research Institute made a tour to southwest Anatolia to make a survey in *Q. aucheri* areas. It was observed that *Q. aucheri* trees had been degraded by local people in different ways such as cutting, overgrazing, acorn collecting, etc. The area has been identified as a *Q. aucheri* community, which should be protected. So the Ege Forest Research Institute has suggested that the General Directorate of National Parks protect this area.

Conclusion

There is limited knowledge of the taxonomic, ecological and genetic characters of oak species in Turkey, so preliminary studies should be based on existing knowledge. *Ex situ* and *in situ* studies should be done, especially for priority species.

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Programme

Wednesday 1 May-arrival of participants

Thursday 2 May

Opening of the meeting

Welcome (Host country and Chair of the Network)
Introduction (IPGRI)
Adoption of the agenda and nomination of rapporteurs

Seminar

Overview of basic concepts and methodologies used in the conservation of forest genetic resources

Progress reports from all countries

Status and practices of gene conservation

Friday 3 May

Research

Overview of ongoing research projects
Discussion on research needs and priorities
New project proposals

Discussion on sharing of gene conservation responsibilities

Presentation of the results of the EUFORGEN Inter-Network meeting
Selection of model ('flagship') species
Distribution maps and inventories
Development of technical standards

Documentation, information and public awareness

EUFORGEN Database/Information platform
Database of genetic resources of Mediterranean oaks
Implementation of photo CD and video
Communication
Bibliography

Saturday 4 May

Field trip (half-day)
Adoption of the report
Date and place of next meeting
Conclusions

Sunday 5 May-Departure of participants

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