


**Final Report**

**ENSCONET**  
*European Native Seed Conservation Network*



**Integrating Activity  
implemented as  
Coordination Action**

Contract number: *RICA-CT-2004-506109*

Project coordinator: *Royal Botanic Gardens, Kew*

Project website: *www.ensconet.eu*

Project Duration: *60 months from 01/11/2004 to 31/10/2009*



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under the "Structuring the European Research Area" specific programme  
Research Infrastructures Action



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## A. ACTIVITY REPORT

### 1 Introduction

The European Native Seed Conservation Network (ENSCONET) project received funding from the European Community's Sixth Framework Programme as an Integrated Activity implemented as a Coordination Action. The project ran for five years from 1<sup>st</sup> November 2004 to 31<sup>st</sup> October 2009. ENSCONET was co-ordinated by The Royal Botanic Gardens, Kew.

ENSCONET has worked in 5 activity areas:

- Management
- Collecting
- Curation
- Data Management
- Dissemination



Seed banking in essence (left to right): Collecting, processing and storing seeds.

### 2 ENSCONET Objective

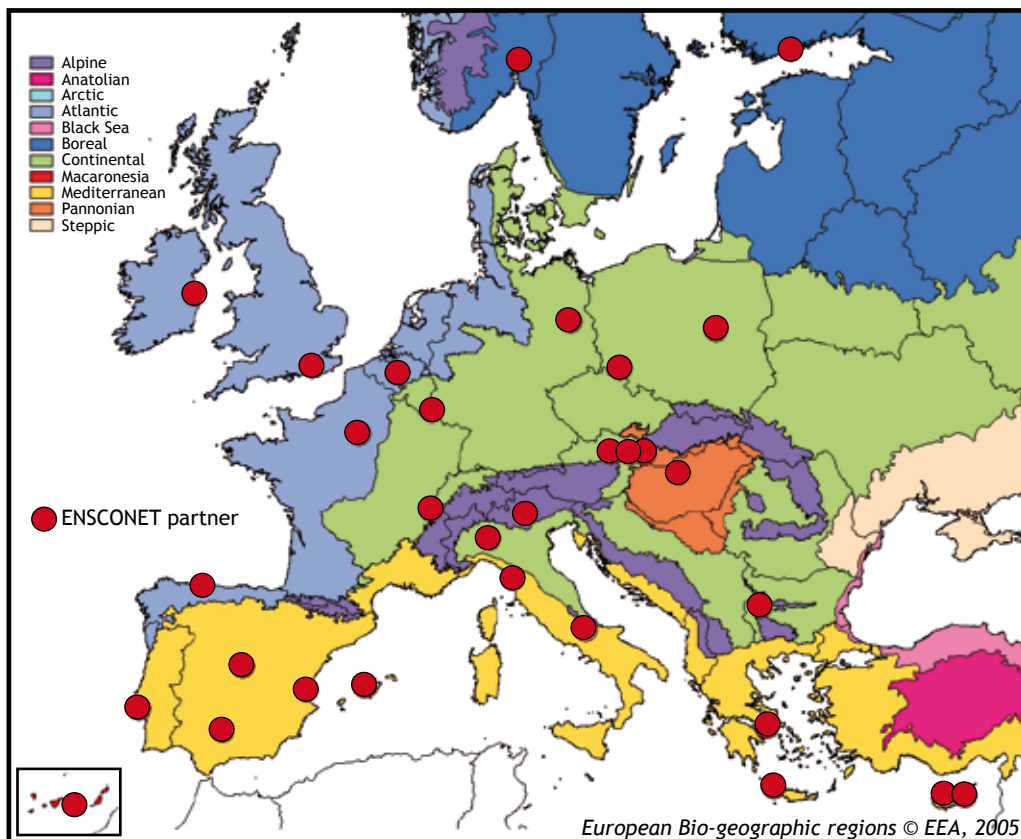
To improve quality, coordination and integration of European seed conservation practice, policy and research for native plant species and to assist EU conservation policy and its obligations to the Convention on Biological Diversity and its Global Strategy for Plant Conservation.

"Europe is very fortunate having a well organized network for the *ex situ* conservation of seeds of plant species - ENSCONET"

*Prof. Vernon Heywood*

*The Impacts of Climate Change on Plant Species in Europe, 2009*

### 3 ENSCONET Partners



### 31 partners in 20 countries worked together to preserve seeds for the future

RBGK - Royal Botanic Gardens, Kew (UK)

NKUA - National and Kapodistrian University of Athens (Greece)

IB SAS - Institute of Botany, Slovak Academy of Sciences, Bratislava (Slovakia)

BZBG - Budapest Zoo & Botanical Garden (Hungary)

MAICh - Mediterranean Agronomic Institute of Chania (Greece)

JB Cordoba - IMGEMA - Jardín Botánico de Córdoba (Spain)

TCD - Trinity College Dublin (Ireland)

Jardín Canario - Jardín Botánico Viera y Clavijo Gran Canaria (Spain)

CYARI - Agricultural Research Institute, Nicosia (Cyprus)

UPM - Universidad Politécnica de Madrid (Spain)

NBGB - National Botanic Garden of Belgium, Meise (Belgium)

MNHN - Muséum National d'Histoire Naturelle, Paris (France)

PAV-UNI-CFA - Università di Pavia / Centro Flora Autoctona della Lombardia (Italy)

Pisa Botanic Garden - Università di Pisa, Orto Botanico (Italy)

JB Soller - Jardí Botànic de Sóller, Mallorca (Spain)

MTSN - Museo Tridentino di Scienze Naturali, Trento (Italy)

UVEG - Universitat de València, Jardí Botànic (Spain)

HBV - Department of Biogeography & Botanical Garden, University of Vienna (Austria)

BG-CBDC-PAS - Botanical Garden - Center of Biological Diversity Conservation of the Polish Academy of Sciences (Poland)

FUB-BGBM - Botanischer Garten und Botanisches Museum Berlin-Dahlem (Germany)

HUBG - Helsinki University Botanic Garden (Finland)

FUL - Botanic Garden, University of Lisbon (Portugal)

NHMOSLO - Botanic Garden, Natural History Museum, University of Oslo (Norway)

IB- BAS - Institute of Botany - Bulgarian Academy of Sciences (Bulgaria)

University of Natural Resources and Applied Life Sciences Vienna\* (Austria)

Musée National d'Histoire Naturelle Luxembourg\* (Luxembourg)

Conservatoire et Jardin botaniques Genève\* (Switzerland)

Frederik University, Nicosia\* (Cyprus)

Rete Italiana Banche del Germoplasma per le Pianti Spontanee Minacciate, RIBES\* (Italy)

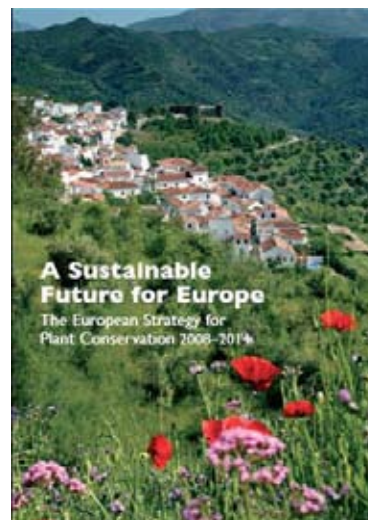
Kostrzyca Forest Gene Bank\* (Poland)

Jardín Botánico Atlántico, Gijón\* (Spain)

\* Associates

## 4 General achievements

- Spirit of collaboration formed between European native species seed banks.
- Single voice created for native species seed banking in Europe.
- Provison of a platform for discussion and the exchange of experience.
- Isolated activities and institutions brought together to maximise impact and reduce duplication of effort.
- Lead partner in European Plant Conservation Strategy (EPC) Targets 3.1 & 8.1 and mentioned as a "Key Success" in EPC.
- Analysis of native seed bank holdings and facilities across Europe carried out.
- Two native seed banking manuals (Collecting and Curation) developed and published on-line.
- On-line seed banking educational tool, the Virtual Tour developed.
- Developed and maintained the project website  
- [www.ensconet.eu](http://www.ensconet.eu)



"The network has linked a powerful group and diversity of institutions to target seed conservation needs for European wild plants for the first time."

*Botanic Gardens Conservation International  
Plant Conservation Report 2009*



5<sup>th</sup> ENSCONET AGM members and Seed Collecting Practical Workshop participants during a field day in the Fassa Dolomites, Trentino, Italy.

## 5 Activity Group N1 Management

### 5.1 Objectives

- Guide the direction of the Network.
- Co-ordinate and monitor activities.
- Prepare management and annual meetings.
- Integrate additional project participants.
- Steer the long-term future of the Network.



### 5.2 Activity Group Details

- 7 Participating Institutes: RBGK (leader), NKUA, JB Cordoba, TCD, Jardín Canario, UVEG, BG-CBDC-PAS.

### 5.3 Major Achievements

- 5 Annual Meetings and 10 Management Meetings held.
- 5 additional full and 7 associate members incorporated into the project.
- Project completed on time and on budget.
- Databases of European seed conservation Projects, Research Groups and Research Papers and Publications.
- External links to conservation and botanic garden agencies strengthened.



ENSCONET members at the 5<sup>th</sup> Annual General Meeting in Trento, Italy.

## 6 Activity Group N2 Collecting

### 6.1 Objectives

- Preparation of a detailed, co-ordinated and prioritised seed collection programme for the European spermatophyte flora which aims to contribute to the time bound targets identified in the Global Strategy for Plant Conservation of the Convention on Biological Diversity, and the Planta Europa/Council of Europe European Strategy for Plant Conservation Strategy, together with the objectives of the EU Sixth Biodiversity Action Plan.
- Promotion of a common, high standard of seed collecting which maximises the genetic diversity (effectiveness) and longevity of the collected seed.

### 6.2 Activity Group Details

- 24 Participating Institutes: All full members led by Jardín Canario.
- The work was organised in 5 tasks with 4 deliverables and 14 milestones.



Selection of seed collecting techniques.



Testing the ENSCONET Collecting Manual in the Italian Dolomites.





Discussing seed collecting techniques in Valenica, Spain.



Mature seed head of *Urginea maritima*.

### 6.3 Major Achievements

- First united list of European native species seed bank holdings produced.
- Future Collecting Plans prepared at the member, national, bioregional and European levels using a novel approach (see page 11).
- European Collecting Plan Report documenting the novel method utilised by ENSCONET compiled.
- ENSCONET Collecting Manual for wild species prepared in 9 languages and made freely available on-line (see page 10).

"There are several academic texts that cover seed collection and conservation, but the ENSCONET Collecting and Curation Manuals are unique and have two clear advantages: they present all contemporary information in two succinct books and the text throughout is clear and well-written in a user-friendly style. As such the Manuals fulfil an important gap in the literature and will undoubtedly have lasting value; helping Europe effectively conserve its plant diversity in face of current ecosystem threat."

*Dr. Nigel Maxted  
University of Birmingham*

## 6.4 Collecting Products

### 6.4a ENSCONET Collecting Manual for wild species

<http://www.ensconet.eu/Download.htm>

The ENSCONET Collecting Manual for wild species documents best practice protocols for collecting seed from Europe's natives plant species. The manual was developed through targeted workshops and extensive testing in the field.

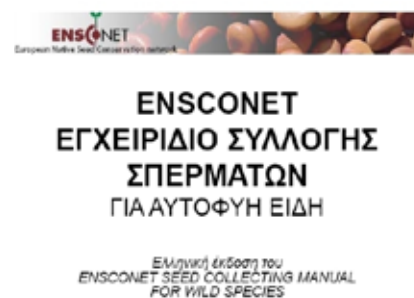
Topics covered include:

- Planning seed collecting expeditions
- Sampling
- Seed collecting techniques
- Plant identification and documentation
- Care of collections after harvest

Importantly, a data passport form is included which will help to ensure accurate and detailed data is collected in the field.

The manual has been prepared in nine languages (English, French, Greek, German, Hungarian, Italian, Polish, Portuguese and Spanish - see examples of the cover pages on the right hand side) to expand its utility. The manual will be of use to seed conservationists and restoration ecologists. It will also be of interest to horticulturists.

The manuals are freely available on the web.



"The ENSCONET Collecting manual provides the collector with comprehensive up-to-date knowledge about the correct protocols required to sample genetic diversity for *ex situ* conservation, and the data required to document these collections."

Anne Cochrane  
Threatened Flora Seed Centre, Western Australia

## 6.4b Collecting Plans

ENSCONET has developed Collecting Plans at the member, national, bioregional and European level using an innovative approach which focuses on bio-geographic plant distributions. The Collecting Plan Report (<http://www.ensconet.eu/Download.htm>) documents the process further and includes case studies (one example is shown on the bottom right hand side) of species included in the bioregional collecting plans.

The advantages of planning collaboratively at the bioregional instead of the local or national level include:

- Avoidance of duplication (making collections with no added value).
- Increased communication between partners and the means to build and strengthen working relationships.
- Ease of adding or amending data following large initial input.
- Improved geographic and genetic representation of sampled accessions.

The development of members' collections plans has allowed institutes to prepare for the future and have a basis for developing/planning scenarios for different future resources. Additionally, these detailed plans are valuable when approaching funders and can be used as a tool to secure additional financial support.

This Collecting Plan has wider application. It can be applied to "shared/overlapping regions" at different scales and could be implemented to co-ordinate shared conservation responsibility of waterways, nature reserves or marine areas.



Field day during the 2<sup>nd</sup> Annual Meeting in Valencia, Spain. Collection case study.

## 7 Activity Group N3 Curation

### 7.1 Objectives

- Inventory the seed conservation facilities and resources available within each of the biogeographic regions of Europe.
- Identify the current best curation practices within ENSCONET and cascade to all participants.
- Assess the capacity of available resources and skills to meet the needs of the seed conservation programme identified in the collecting work.
- Identify the necessary research to further enhance the value of seed banking in the conservation, restoration and sustainable use of the native European spermatophyte flora.



Section of storage containers.



Visits to Gran Canaria Botanic Garden and Warsaw Botanic Garden seed banks.



Participants of the ENSCONET Germination workshop, Meise Belgium, 2009.

## 7.2 Activity Group Details

- 16 Participating Institutes: RBGK, NKUA, BZBG, MAICH, JB Cordoba, CYARI, UPM, NBGB, MNHN, PAV-UNI-CFA, MTSN, UVEG, HBV, BG-CBDC-PAS (leader), FUL, IB-BAS.
- The work was organised in 5 tasks with 7 deliverables and 10 milestones.

## 7.3 Major Achievements

- List of *ex situ* native species collections held in major European seed banks compiled.
- European seed conservation facilities documented.
- Resources and skill capacities assessed in relation to collecting plans.
- ENSCONET Curation Protocols and Recommendations published on-line in nine languages (see page 14).
- Five diverse funding applications submitted.
- All partners participated in exchange visits.
- Seed bank advice given to numerous European seed banks.
- 61 % of critically endangered species held in duplicate storage.



A visit to the seed bank at NBGB.



X-ray image of a seed sample.

## 7.4 Curation Product

### 7.4a ENSCONET Curation Protocols and Recommendations

<http://www.ensconet.eu/Download.htm>

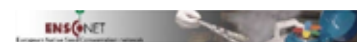
The ENSCONET Curation Protocols and Recommendations document best practices for seed bank curation. It has been developed through a number of workshops.

Topics covered include:

- Seed cleaning
- Seed drying
- Moisture monitoring
- Packing
- Long-term storage
- Basic germination testing
- Verification
- Data
- Seed regeneration
- Seed distribution

The manual has been prepared in nine languages (English, French, Greek, German, Hungarian, Italian, Polish, Portuguese and Spanish - see examples of the cover pages on the right hand side) to expand its utility. The manual will be of use to seed bank practitioners and seed conservationists.

The manuals are freely available on the web.



"The production of collecting and the curation manuals for wild plant species by ENSCONET team is an important achievement for helping conservationist around the world (and not only Europe) to effectively and efficiently sample the plant population and maintain plant diversity in *ex situ* collections. The manuals are of high standards and will be an authoritative reference for many users involved in plant conservation. "

*Dr. Ehsan Dulloo  
Biodiversity International*

## 8 Activity Group N4 Data Management

### 8.1 Objectives

- Use common data standards to bring about the integration of the collection data held by partners in ENSCONET.
- Seek the further integration of these data into other parallel EU initiatives such as EPGRIS.
- Deliver easier access to the collections by researchers across Europe and facilitate the improved use within Europe of electronic data relevant to seed conservation e.g., Geographical Information Systems.

### 8.2 Activity Group Details

- 12 Participating Institutes: RBGK, NKUA, IB SAS, MAICH, JB Cordoba, TCD (leader), CYARI, NBGB, Pisa Botanic Garden, UVEG, HUBG, FUL.
- The work was organised in 5 tasks with 5 deliverables and 7 milestones.

### 8.3 Major Achievements

- Database schema (including standards) developed for shared seed bank data.
- Protocol for recording germination data agreed.
- ENSCOBASE - European database on wild plant species (41928 accessions) freely accessible on-line (see page 16).
- ENSCOTOOL - data management system developed (see page 17).
- Demonstrate through analysis that the database shows that ENSCONET members hold 44 % of Habitats Directive Species and 27 % of BGCI threatened European plants list.



Development and use of data management systems.

## 8.4 Data Management Products

### 8.4a ENSCOBASE

<http://enscibase.maich.gr/>

ENSCOBASE is the on-line database of the ENSCONET project. It is a Virtual Seed Bank, as it stores data on accessions from 29 European seed banks. Since July 2009 this database has been freely accessible. Seed availability is shown along with contact details for all holding seed banks.

To date ENSCOBASE holds data from or on:

- 41928 accessions
- 9294 taxa
- 20934 germination tests
- 29 institutes
- 40 countries
- 11 bio-geographic regions

The left screenshot shows the main search page for the genus *Astragalus*. It features a navigation menu with options: Taxon, Geographic area, Germination, Conservation, and Complex search. Below the menu is a search bar with the text 'Genus Astragalus:' and a 'New search' button. A table lists various taxa and their corresponding number of accessions.

Taxon	Number of accessions
<i>Astragalus alopecuroides</i> L. BGCI	4
<i>Astragalus alopecurus</i> Pallas	1
<i>Astragalus alpinus</i> L.	5
<i>Astragalus angustifolius</i> Lam.	1
<i>Astragalus asper</i> Jacq.	1
<i>Astragalus austragaenus</i>	3
<i>Astragalus australis</i> (L.) Lam.	3
<i>Astragalus baeticus</i> auct.	5
<i>Astragalus balearicus</i> Chater	10
<i>Astragalus bourgaeanus</i> Coss.	1
<i>Astragalus bungeanus</i> Boiss.	1
<i>Astragalus centralpinus</i> HDI	1
<i>Astragalus cicer</i> L.	3
<i>Astragalus clusianus</i> Soldano	3
<i>Astragalus clusii</i>	1
<i>Astragalus comiculatus</i> M.Bieb.	1
<i>Astragalus creticus</i> Lam. subsp. <i>creticus</i> (synonym)	2
<i>Astragalus cypricus</i> Boiss.	2
<i>Astragalus cyri</i> Fomin	1

The right screenshot shows the 'Close Taxonomy window' for *Astragalus alpinus* L. It provides detailed taxonomic information, including the family (LEGUMINOSAE), division (Angiosperm), and vernacular names (Astragale des Alpes (French)). It also lists external links for Flora Europaea, IPNI, BGC Plant Search, EUNIS Distribution, and STD (Storage & Literature). The 'Ecology' section notes that fruit type and seed storage behaviour information is not available. The 'Threat status information' section indicates that the species is not in the BGC European Threatened Taxa Lists or the EU Habitats Directive List Annex II, and is not in any bio-geographical regions (EUCN categories).

EUCN Category	Status
EUCN Alpine	VU
EUCN Arctic	No information available
EUCN Atlantic	VU
EUCN Black Sea	No information available
EUCN Boreal	No information available
EUCN Continental	No information available
EUCN Macaronesian	No information available
EUCN East-Mediterranean	No information available
EUCN West-Mediterranean (France-Italy)	No information available
EUCN West-Mediterranean (Portugal-Spain)	No information available
EUCN Paenonian	No information available

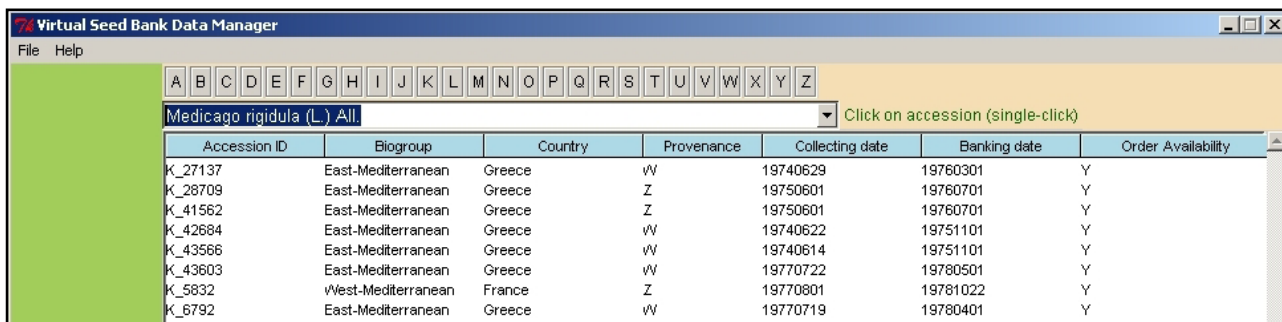
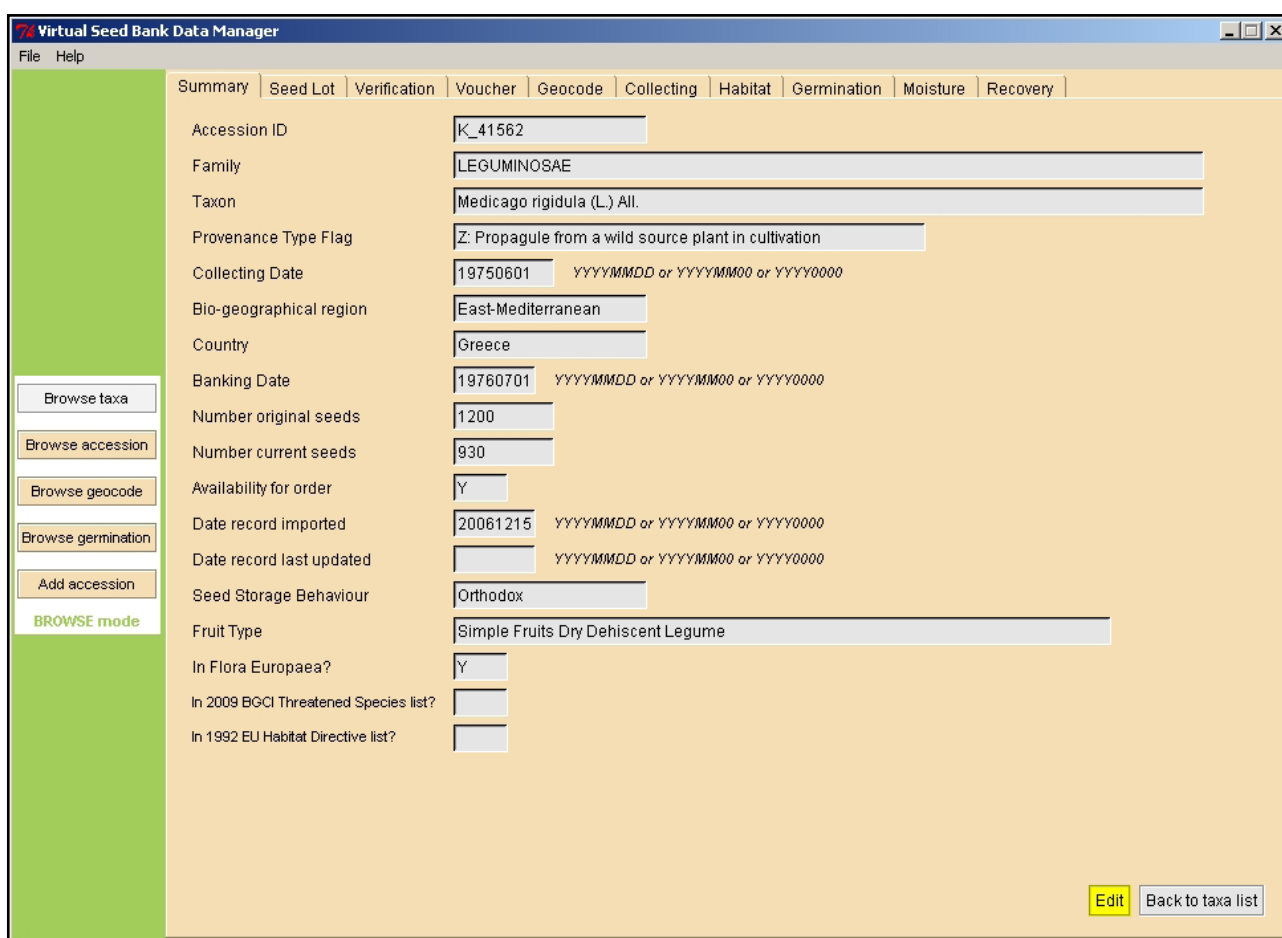
Screen shots from ENSCOBASE.



### 8.4b ENSCOTOOL

ENSCOTOOL, a Virtual Seed Bank Data Manager, was developed through the ENSCONET project to allow partners to manage their content in ENSCOBASE. Existing data can be amended or updated and new records can be added. Data standards are implemented in the tool including a set of mandatory fields. ENSCOTOOL allows the utility of ENSCOBASE to be continued beyond ENSCONET.

ENSCOTOOL can also act as a stand-alone seed conservation data management system.



Screenshots from ENSCOTOOL.

## 9 Activity Group N5 Dissemination

### 9.1 Objectives

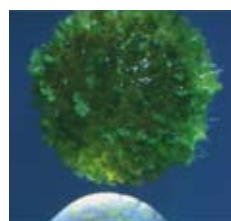
- To establish a continuous open communication route, to exchange specialised information between all ENSCONET participants.
- To provide all seed conservation groups with efficient tools to improve working methodologies. In particular to disseminate standard and recommended protocols on seed conservation.
- To provide information on ENSCONET and its products to the wider scientific community, including users of seed banks, decision makers and policy makers.
- To give plentiful information about ENSCONET and its participants to the general public.

### 9.2 Activity Group Details

- 7 Participating Institutes: RBGK, MAICH, JB Cordoba, Jardín Canario, UVEG (leader), CYARI, HBV.
- The work was organised in 5 tasks with 3 deliverables and 9 milestones.

### 9.3 Major Achievements

- Five issues of the annual news bulletin ENSCONEWS produced and widely distributed in 20 countries (front covers shown at the bottom of this page).
- Website developed and maintained in English, French and Spanish.
- E-forum set up and utilised for general communication and e-meetings.
- Educational tool, the Virtual Tour, developed in nine languages (DVD and on-line; see page 19).
- Promotional leaflets and bookmarks produced and distributed.
- Project results and activities disseminated in over 90 conference presentations.
- Significant news coverage: 169 press articles (of which 63 in specialist press), 11 radio features and 2 television features.

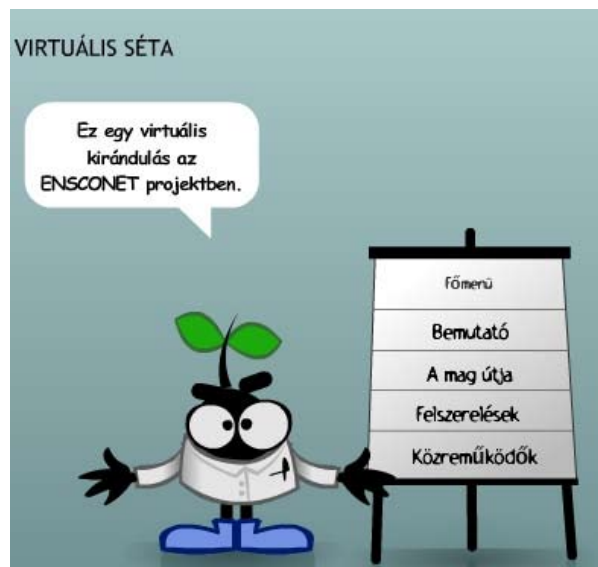


## 9.4 Dissemination Product

### 9.4a Virtual Tour

[www.ensconet.eu/Tour.htm](http://www.ensconet.eu/Tour.htm)

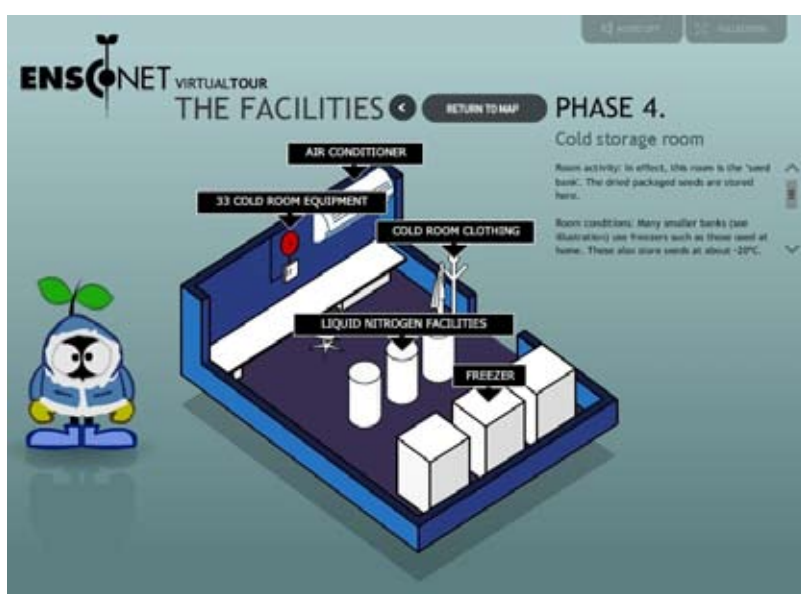
The Virtual Tour is a seed bank educational tool aimed at users aged 9 and upwards. It has three sections: Presentation; The Process and Facilities. During the first two sections an animated seed character explains why *ex situ* conservation is needed and how seed banking works. The third section is an interactive seed bank which the user can explore and view photos, video and detailed text descriptions of processes and equipment.



This completed product is available on-line at [www.ensconet.eu/Tour.htm](http://www.ensconet.eu/Tour.htm) and can also be reached through several Institutional websites.

A DVD version was also produced and has been distributed by ENSCONET members to primary schools.

To make dissemination of the Virtual Tour easier the product does not have copyright but the images remain property of the providing institutes.



Screenshots from the Hungarian, Spanish and English versions of the Virtual Tour.

## 10 Dissemination and Use

The following completed products have been generated during the ENSCONET project:

- ENSCONET Collecting Manual for wild species (see page 10)
- Collecting Plans (see page 11)
- ENSCONET Curation Protocols and Recommendations (see page 14)
- ENSCOBASE (see page 16)
- ENSCOTOOL (see page 17)
- Virtual Tour (see page 19)

In the future European seed banks would like to engage with more seed users from research and industry. Up to now this communication has been focused on seed requests and material supply. The products developed through ENSCONET have been prepared independently of industry collaboration and do not have direct commercial applications.

It is expected that these products will stimulate and improve standards in the seed banking and community and more widely to the European researchers. ENSCOBASE will continue to function gathering and making data available via the website.

The Virtual Tour will continue to introduce why seed banking is important and how seed banking is carried out to school children and young researchers.



ENSCONET members discussing poster presentation in Warsaw, Poland.

## 11 Outlook

### **What has changed over the last five years?**

Only a few years ago, before the launch of ENSCONET in November 2004, little co-ordination between the native seed banks in Europe occurred. Seed banks acted in an un-coordinated way at local, regional or national levels, adopting different working standards. The accessions that existed in Europe had been collected over many years in an ad hoc fashion with varied quality and effectiveness and storing methods. Although individual seed banks offered access to seed material, there was no integrated database listing available material, making it very difficult for users to locate and request seeds.

ENSCONET for the first time unified all key facilities for European native seeds, and much has changed over the last five years. Today, European native seed banks speak with one voice, have defined high level, common working standards, exchange staff regularly, and most share their holding data in a freely accessible web-based database, to list only a few of the achievements.

### **Safeguarding Europe's plant diversity**

Conservation is a very strong justification for seed banks. On a continent where habitat fragmentation, habitat destruction and land conversion for human use continue apace and where the effects of climate change have yet to be quantified with certainty, the conservation of wild plants in Europe has never been more important. Native seed banks provide an insurance policy against the loss of natural plant diversity in its wild habitats. Seed collections will prove to be an essential resource in finding solutions to threats to wild plant diversity.

### **The use of seed material**

However, for us to store and provide the most valuable collections, there will need to be much greater dialogue with end users. Looking at past examples of seed material and associated data use in a wide range of scientific disciplines, the huge significance of native seed banks and their continued and expanded coordinated collaboration on a European scale becomes obvious. In addition to conservation, the potential of native seed banks as providers of high quality seeds as a basis for scientific research (accompanied by reliable and accurate data) has only very recently been identified as a second major driver for seed banks, in particular in Europe and in other developed areas of the world. This driver will very likely become even stronger in the years to come. Maintaining the balance between seed banks' traditional interest in threatened plants and demonstrating usefulness will be both challenging and stimulating.



### **The future**

The EU Member States and the European Commission have identified the need to continue the support for native seed banks and seed conservation on a European scale in order not to lose the significant dialogue and momentum gained and to expand further and open up activities.

ENSCONET members are aiming to:

- Keep the project website open and continue management of the database
- Maintain the dialogue, momentum and collaborative spirit generated through ENSCONET.
- Maintain and extend the seed bank network in Europe.
- Extend existing activities and open them to further banks in other EU Member States, and elsewhere in and outside Europe.
- Implement agreed standards in partner seed banks and encourage banks outside the network to use them.
- Secure external funding for future seed conservation activities.





Photographs in this report are copyright of the contributing ENSCONET members.

***B. FINAL MANAGEMENT REPORT (FINANCIAL INFORMATION)***

*Please see Appendix 4 - Summary financial report and Appendix 5 - Personnel effort for the whole duration of the project.*

***C. FINAL REPORT ON THE DISTRIBUTION OF THE COMMUNITY FINANCIAL CONTRIBUTION***

*This will follow after the final payment has been received.*

***D. QUESTIONNAIRES***

Please see completed questionnaires D1-D3 on SESAM system.