AEGRO AND GENETIC RESERVE METHODOLOGIES: 2 - NATIONAL APPROACH

Joana Magos Brehm, Nigel Maxted, Brian V. Ford-Lloyd, M. Amélia Martins-Loução
SESSION OBJECTIVES

- National CWR strategy
- National approach to CWR in situ conservation: the model
- Portuguese CWR as a case-study

  - Inventory
  - Priorities
  - Ecogeographic survey
  - Genetic diversity

- Conclusions and relevant points
- Acknowledgments
**Why a National CWR Strategy?**

- CWR are a unique national resource
- CWR are becoming more *threatened* (human activities, climate change, etc) and therefore are suffering from genetic erosion
Why a National CWR Strategy?

- Legislative requirement to conserve
- CWR require an integrated *in situ* / ex situ approach, best implemented via a National CWR Strategy
- No single method of generation
National CWR Strategy

Two levels of implementation:

1. Strategic / national
   - Important CWR Areas
   - Network of national CWR reserves

2. Practical / local
   - Individual national CWR reserves
   - CWR conservation in protected area
National Approach to CWR In Situ Conservation - Model

Focus on national flora, taxonomic and genetic diversity available in the country.
PORTUGUESE NATIONAL CWR: CASE-STUDY
MAIN QUESTIONS

What to conserve?

Do not know which CWR occur in Portugal!

Which CWR are more important?

Do we need to conserve all populations?

Where are they located?
Question: Which CWR exist in Portugal mainland?

PORTUGUESE CWR INVENTORY
**Methodology**

**Portuguese CWR Inventory**

- **Crop genus names** Mansfeld’s database
- **Medicinal & aromatic genus names** MAPROW
- **Forestry genus names** Schultze-Motel (1966)
- **Ornamental genus names** CPVO

Matching processes flow into:

- **Euro+Med Plantbase genus names**
- **Data mining**

**European and Mediterranean Catalogue of CWR (Kell et al., 2005)**
PORTUGUESE CWR INVENTORY

European and Mediterranean Catalogue of CWR (Kell et al., 2005)

Country filter

Portuguese CWR

Ethnobotanical uses
Economic value
Ex situ conservation
In situ conservation

Taxonomic harmonisation

Global distribution
National distribution
Threatened status
Legislation

Flora Iberica / Flora de Portugal

PORTUGUESE CWR DATABASE

Internet
www.jb.ul.pt
PORTUGUESE CWR INVENTORY

CWR: 2262 taxa  
(109 families, 471 genera)  

~ 75% of Portuguese Flora

Main results

<table>
<thead>
<tr>
<th>Use</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>27.7%</td>
</tr>
<tr>
<td>Aromatic and Medicinal</td>
<td>31.5%</td>
</tr>
<tr>
<td>Ornamental</td>
<td>20.6%</td>
</tr>
<tr>
<td>Forage/Fodder</td>
<td>17.4%</td>
</tr>
<tr>
<td>Industrial</td>
<td>0.9%</td>
</tr>
<tr>
<td>Forestry</td>
<td>0.6%</td>
</tr>
<tr>
<td>Other uses</td>
<td>1.4%</td>
</tr>
</tbody>
</table>
PORTUGUESE CWR INVENTORY

Main results

- Leguminosae, Compositae, Poaceae – higher number of CWR;
- ~ 92% are native;
- ~ 6.2% are endemic to Portugal, 11.5% are endemic to Iberian Peninsula;
- Only 12.2% are currently conserved in Genebanks;
- Only 0.5% are actively conserved in situ;
- ~ 6.0% are under any kind of national/international legislation.
**Main Questions**

- **What to conserve?**
  - ✓ **NATIONAL INVENTORY OF CWR**

- **Do we need to conserve all populations?**

- **Which CWR are more important?**
  - Do not know which species are more important...

- **Where are they located?**
Question: Which species are more important to conserve?

Setting conservation priorities for the conservation of CWR in Portugal
1. Criteria used

- Native status
- Threatened status (e.g. IUCN Red List Criteria)
- Economic value
- Ethnobotanical value
- Current *in situ* and *ex situ* conservation status
- National and international legislation
- Global distribution
- National distribution
2. Prioritising – final procedure

- Point Scoring Procedure
- Point Scoring Procedure with Weighting
- Compound Ranking System
- Binomial Ranking System

Priority Species: those belonging to the top 50 species of each method and that occur in more number of methods.
<table>
<thead>
<tr>
<th>SPECIES NAME</th>
<th>SPECIES NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allium pruinatum</td>
<td>Leuzea longifolia</td>
</tr>
<tr>
<td>A. schmitzii</td>
<td>Narcissus fernandesii</td>
</tr>
<tr>
<td>A. victorialis</td>
<td>N. scaberulus</td>
</tr>
<tr>
<td>Daucus halophilus</td>
<td>Plantago algarbiensis</td>
</tr>
<tr>
<td>Dianthus cintranus subp. barbatus</td>
<td>P. almogravensis</td>
</tr>
<tr>
<td>D. cintranus subsp. cintranus</td>
<td>Quercus canariensis</td>
</tr>
<tr>
<td>D. loricifolius subsp. marizii</td>
<td>Trifolium arvense subsp. gracile</td>
</tr>
<tr>
<td>Epilobium angustifolium</td>
<td>Ulex densus</td>
</tr>
<tr>
<td>Festuca brigantina</td>
<td>Vicia bithynica</td>
</tr>
<tr>
<td>F. henriquesii</td>
<td>V. onobrychioides</td>
</tr>
<tr>
<td>Herniaria algarvica</td>
<td>V. orobus</td>
</tr>
</tbody>
</table>

**Results**

Setting conservation priorities for the conservation of CWR in Portugal

22 PRIORITY SPECIES
Main questions

What to conserve?
✓ NATIONAL INVENTORY OF CWR

Which CWR are more important?
✓ PRIORITY SPECIES FOR CONSERVATION

Do we need to conserve all populations?

Where are they located?

ECOGEOGEOGRAPHIC SURVEY
Question: Where are the priority species located?

ECOGEOGRAPHIC SURVEY OF PRIORITY SPECIES FOR CONSERVATION
1 - Herbaria survey

- 10 Portuguese herbaria and 1 Spanish herbarium
- 3 online herbaria
Eco-geographic survey of priority species for conservation

2 - Genebank survey

- 5 Portuguese genebanks
- 10 online genebanks
ECOGEOGRAPHIC SURVEY OF PRIORITY SPECIES FOR CONSERVATION

Total 796 records
Vicia bithynica (L.) L.

- **Related crop**: faba beans (food, forage/fodder)
- **Habitat**: cereal fields, margins of paths
- **Global distribution**: S, W Europe until Middle East, NW Africa and Azores
- **National distribution**: 4 provinces
- **In situ conservation**: not active and only 2 known populations are inside a conservation area
- **Ex situ conservation**: 3 samples
- **Legislation**: none
- **IUCN category (2001)**: Vulnerable (VU)
- **Threats**: invasive species (*Carpobrotus edulis*), building, trampling.
MAIN QUESTIONS

What to conserve?

✓ NATIONAL INVENTORY OF CWR

Which CWR are more important?

✓ PRIORITY SPECIES FOR CONSERVATION

Do we need to conserve all populations?

GENETIC DIVERSITY

Where are they located?

✓ ECOGEOGRAPHIC SURVEY
Question: Do we need to conserve all the populations?

Genetic diversity study for the target species
1 - Species selection

- from the 22 priority species, those ones occurring in single locations, with taxonomic issues or already being studied were excluded; left with 9 species

2 - Collecting mission

- for the 9 target species, locations with a wide range of environments and ecogeographic conditions were chosen
- only 5 species were found in the field!
Methodology

2 - Collecting mission (cont.)

*Allium victorialis* L.
Methodology

2 - Collecting mission (cont.)

*Dianthus cintranus* Boiss. & Reut. subp. *barbatus* R. Fern. & Franco
2 - Collecting mission (cont.)

*Dianthus cintranus* Boiss. & Reut. subsp. *cintranus*
GENETIC DIVERSITY STUDY FOR THE TARGET SPECIES

Methodology

2 - Collecting mission (cont.)

Dianthus laricifolius Boiss. & Reut. subsp. marizii (Samp.) Franco
2 - Collecting mission (cont.)

*Vicia bithynica* (L.) L.
4 - Amplified Fragment Length Polymorphism (AFLP)

Methodology

- F-statistics
- Genetic distance
- AMOVA
- Regression analysis with ecological variables
**GENETIC DIVERSITY STUDY FOR THE TARGET SPECIES**

**Vicia bithynica (L.) L.**

Some results

**Principal Coordinates (2 vs 3)**

AMOVA (Analysis of Molecular Variance):
- Among populations: 27%
- Within populations: 73%

Conserving 2 populations: 7.3% of genetic variation left out

Fst = 0.171 => populations are different!
MAIN QUESTIONS

What to conserve?

☑ NATIONAL INVENTORY OF CWR

Which CWR are more important?

☑ PRIORITY SPECIES FOR CONSERVATION

Do we need to conserve all populations?

☑ AFLP ANALYSIS

Where are they located?

☑ ECOGEOGRAPHIC SURVEY
**CONCLUSIONS AND RELEVANT POINTS**

1. CWR Inventory

- Time-consuming but then it only needs an update
- Problem of country with poorly known flora
- ‘Standard route’ = Flora to crops to CWR inventory (semi-automated)
- ‘Alternative route’ = Crops to flora to CWR inventory (via workshop)
CONCLUSIONS AND RELEVANT POINTS

2. Prioritising CWR taxa / diversity

- Limited conservation resources
- Broad CWR definition with generic limit = relative large number of taxa
- Other factors should be considered: genetic distinctiveness, biological importance, cost, sustainability, ethical and aesthetic considerations, and priorities of the conservation agency.
- No single method: it depends on the information available and the priorities of each country
CONCLUSIONS AND RELEVANT POINTS

3. Ecogeographic survey

- Data might be dispersed and not easily accessible
- GIS software might not be easy to use
- It is an important tool:
  - To plan further field work/collecting missions
  - To understand the distribution and ecological characteristics of taxa
  - To help in developing prediction of distribution models
CONCLUSIONS AND RELEVANT POINTS

4. Genetic diversity

- Can be expensive
- Requires specific molecular technology and equipment
- Allows to know the genetic diversity available in the species distribution range
- Helps to decide which populations are priorities to conserve
ACKNOWLEDGMENTS

- Shelagh Kell (University of Birmingham, UK)
- Maria Scholten (University of Birmingham, UK)
- Eliseu Bettencourt (EAN, Portugal)
- Pedro Ivo Arriegas (ICN, Portugal)
- António Flôr (PNSAC, Portugal)
- Fundação para a Ciência e Tecnologia (FCT, Portugal)
- all curators of herbaria and genebanks

...
AEGRO AND GENETIC RESERVE METHODOLOGIES: 2 - NATIONAL APPROACH

Joana Magos Brehm, Nigel Maxted, Brian V. Ford-Lloyd, M. Amélia Martins-Loução