CONSERVATION STRATEGY FOR CROP WILD RELATIVES AND WILD HARVESTED PLANTS IN PORTUGAL

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

- CWR and WHP, what are they?
- Why do we need a national CWR and WHP Strategy?
- Portuguese CWR and WHP as a case-study
- Conclusions and relevant points
CROP WILD RELATIVES (CWR)

Those species that are taxonomically / genetically related to crops to which they may contribute genes via traditional breeding and biotechnology.

WILD SPECIES UNDER THE SAME GENUS AS CROP SPECIES

“A wild plant taxon that has an indirect use derived from its relatively close genetic relationship to a crop; this relationship is defined in terms of the CWR belonging to Gene Pools 1 or 2, or Taxon Groups 1 to 4 of the crop” (Maxted et al., 2006)
Plants traditionally **collected from the wild** primarily used by local people as a source of food, medicines, fibres, dyes, oils, poisons, used in magic and religious traditions...

- Ethnobotanical / traditional value
- Small scale economic value
- Potential economic value

Why a National CWR and WHP Strategy?

- Unique national resources
- Becoming more threatened (human activities, climate change, etc) and therefore are suffering from genetic erosion
Why a National CWR and WHP Strategy?

- Legislative requirement to conserve
- CWR and WHP require an integrated \textit{in situ} / \textit{ex situ} approach, best implemented via a National Strategy
- No single method of generation
PORTUGUESE CWR AND WHP:  
CASE-STUDY
MAIN QUESTIONS

What to conserve?

Which CWR and WHP are more important?

Where to implement national genetic reserves?

Where to target ex situ collections?

NATIONAL INVENTORY OF CWR and WHP
Which CWR and WHP exist in mainland Portugal?

Portuguese CWR and WHP inventory
PORTUGUESE CWR AND WHP INVENTORY

METHODOLOGY

- **National ETHNOBOTANICAL literature**
- **EUROPEAN and MEDITERRANEAN CWR Catalogue** (www.pgrforum.org)

- **Portuguese WHP**
- **Portuguese CWR**

- **CWR + WHP SPECIES**
  - Ethnobotanical uses
  - Economic value
  - *Ex situ* conservation
  - *In situ* conservation

- **Taxonomy harmonisation**
  - Global distribution
  - National distribution
  - Threatened status
  - Legislation

- **PORTUGUESE CWR + WHP INVENTORY** (www.jb.ul.pt)

(Magos Brehm *et al.*, 2008)
PORTUGUESE CWR AND WHP INVENTORY

MAIN RESULTS

2319 taxa
(122 families, 524 genera)

97% CWR
21% WHP
19% both CWR + WHP

- ~93% are native;
- ~6% are endemic to Portugal, 11% are endemic to Iberian Peninsula;
- ~16% are threatened;
- Only 12% are currently conserved in Genebanks;
- Only 0.5% are actively conserved in situ;
- ~6% are under any kind of national/international legislation.

(Magos Brehm et al., 2008)
MAIN QUESTIONS

What to conserve?

Which CWR and WHP are more important?

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✓ NATIONAL INVENTORY OF CWR and WHP

PRIORITISE CWR and WHP AT NATIONAL LEVEL
WHICH SPECIES ARE MORE IMPORTANT TO CONSERVE?

ESTABLISHING CONSERVATION PRIORITIES FOR CWR AND WHP IN PORTUGAL
SETTING CONSERVATION PRIORITIES FOR THE CONSERVATION OF CWR AND WHP IN PORTUGAL

METHODOLOGY

PORTUGUESE CWR and WHP INVENTORY

- Ethnobotanical uses
- Economic value
- Ex situ conservation
- In situ conservation

Global distribution

- National distribution
- Threatened status
- Legislation

Point scoring procedure (PSP)

Point scoring procedure with weighing (PSP)

Compound ranking system (CRS1, CRS2, CR3)

Binomial ranking system (BRS1, BRS2, BRS3)

50 top species

Species occurring in ≥ 4 methods

22 Priority CWR and WHP Species
### Setting Conservation Priorities for the Conservation of CWR and WHP in Portugal

#### Main Results

<table>
<thead>
<tr>
<th>Species Name</th>
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</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 carota subsp. halophilus</td>
<td>Plantago algarbiensis</td>
</tr>
<tr>
<td>Dianthus cinranus subsp. barbatus</td>
<td>P. almogravensis</td>
</tr>
<tr>
<td>D. cinranus subsp. cinranus</td>
<td>Quercus canariensis</td>
</tr>
<tr>
<td>D. laricifolius 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>

**22 Priority Species**
MAIN QUESTIONS

What to conserve?

Which CWR and WHP are more important?

Where to implement national genetic reserves?

Where to target *ex situ* collections?

✓ NATIONAL INVENTORY OF CWR and WHP

✓ PRIORITIZE CWR and WHP AT NATIONAL LEVEL

ECOGEOGRAPHIC SURVEY

GAP ANALYSIS

GENETIC DIVERSITY STUDY

CLIMATE CHANGE MODELLING
WHERE TO IMPLEMENT GENETIC RESERVES?
WHERE TO TARGET *EX SITU* COLLECTIONS?

ECOGEOGRAPHIC SURVEY
GAP ANALYSIS

GENETIC DIVERSITY
CLIMATE CHANGE MODELLING
1 - Ecogeographic survey and gap analysis

- Mainly Portuguese and online herbaria and genebanks
**2 - Genetic diversity**

- undertaken for 5 taxa
- about 5-7 populations per species
- AFLP
3 - Species distribution prediction with climate change

- **Software:** Maxent v. 3.2.1 (maximum entropy model) (Phillips *et al.*, 2006)
- **Current climate data:** WorldClim v. 1.3 (Hijmans *et al.*, 2005) (19 bioclimatic variables)
- **Future climate scenario:** Community Climate Model version 3 (CCM3) (Govindasamy *et al.* 2003)
  - \([\text{CO}_2 \text{ atm}] = 600 \text{ ppm}\)
  - predicted to occur \(~2100\)
  - \(2 \times [\text{CO}_2 \text{ atm}]\) of that of pre-industrial era
- **Measuring climate change:**
  - # of grid cells of highly suitable areas and the extent of suitable area in both climate scenarios
  - identification of conservation areas more affected by climate change
**In situ and ex situ recommendations for priority CWR and WHP taxa**

### Main Results

**1 - In situ recommendations**

- **68% of priority species** conserved (passively) in 3 existing conservation areas
- Genetic reserves establishment needed for active conservation

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**NP Montesinho:**
- *D. laricifolius* subsp. *marizii*
- *E. angustifolium*
- *F. henriquesii*

**NtP Peneda-Gerês:**
- *A. victoriaii*
- *E. angustifolium*
- *F. henriquesii*
- *V. orobus*

**NP Sintra-Cascais:**
- *D. carota* subsp. *halophilus*
- *D. cinranus* subsp. *barbatus*
- *D. cinranus* subsp. *cinranus*
- *V. bithynica*
- *U. densus*

**In situ** recommendations
- *F. brigantina*
- *T. arvense* var. *gracile*
- *V. onobrychioides*
- *V. orobus*
- *F. henriquesii*
- *V. orobus*

- 68% of priority species conserved (passively) in 3 existing conservation areas
- Genetic reserves establishment needed for active conservation
2 - *Ex situ* recommendations

Priority taxa **not represented** by seed accessions or present valid passport data

- More endangered and more **negatively affected by climate change**
  - *Dianthus cintranus* subsp. *barbatus*
  - *D. cintranus* subsp. *cintranus*
  - *D. laricifolius* subsp. *marizii*
  - *Epilobium angustifolium*

- **Not included** in the suggested reserves
  - *Allium pruinatum* (including *A. pruinatum* var. *bulbiferum*)
  - *Herniaria algarvica*

- All species need to be sampled BUT which are PRIORITIES?
  - *Festuca brigantina*
  - *Herniaria algarvica*
  - *Leuzea longifolia*
  - *Quercus canariensis*
CONCLUSIONS AND RELEVANT POINTS

- CWR and WHP are important resources for human nutrition and food security;
- They are under threat of habitat loss and climate change, and are often overlooked in conservation planning;
- There is an urgent need to develop conservation strategies at national level to conserve these resources;
CONCLUSIONS AND RELEVANT POINTS

- There is **no single method** of generating a National Strategy for the conservation of CWR and WHP: it depends on the information available and the priorities of each country;

- I have outlined the basic methodology used to make *in situ* and *ex situ* conservation recommendations for the conservation of the priority Portuguese CWR and WHP.
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