Crop wild relatives in EURISCO - Portugal

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CHECKLIST AND PRIORITY CWR FOR PORTUGAL

First iteration of the Portuguese CWR checklist (Magos Brehm *et al.* 2008)

First CWR prioritization for conservation (Magos Brehm *et al.* 2010)

RESEARCH ARTICLE

National inventories of crop wild relatives and wild harvested plants: case-study for Portugal

Joana Magos Brehm · Nigel Maxted · Brian V. Ford-Lloyd · Maria Amélia Martins-Loução

Abstract Crop wild relatives (CWR) and wild harvested plant species (WHP) constitute an important element of a nation's plant genetic resources (PGR) available for utilisation. Although their natural populations are threatened like other wild species by habitat lost and fragmentation, little attention has generally been paid to their systematic conservation. The development of checklists and inventories is considered by the convention on biological diversity (CBD) and the global strategy for plant conservation (GSPC) as the first step in any national strategy for conservation and sustainable use of plant diversity. Methodological approaches to the development of a national inventory of wild PGR are discussed in the light of a case-study for the CWR and WHP growing in mainland Portugal. The resultant inventory comprises 2319 taxa, of which 97.5% are CWR, 21.4% are WHP and 19.0% are both CWR and WHP. Approximately 6.1% are endemic to mainland Portugal; 24.1% occur in 1 to 4 Portuguese administrative regions; 15.6% are threatened, but only 5.9% are covered by legislative protection. Taxonomic misalignments and the dispersed nature of biological literature were the major impediments to the production of the national inventory, but once the inventory was established it has proven to be a powerful tool in conservation management.

Keywords Conservation · Databases · Management tool · Methodologies · Plant genetic resources

Introduction

Crop wild relatives (CWR) are those taxa related to species of direct socio-economic importance, including food, fodder and forage crops, medicinal plants, condiments, ornamental and forestry species, as well as plants used for industrial purposes such as oils and fibres (Kell et al. 2007). They are components of both natural habitats and agroecosystems and may contain desirable genes that can enhance pest resistance, or improve the nutritional value or flavour of crops (IPGRI 1993). Hajjar and Hodgkin (2007) have recently reviewed how CWR have been used for crop development and improvement in the last 20 years. Maxted et al. (2006) provided a working definition for CWR derived from the gene pool concept proposed by Harlan and de Wet (1971),

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ORIGINAL PAPER

New approaches for establishing conservation priorities for socio-economically important plant species

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Abstract The establishment of priorities among species is a crucial step in any conservation strategy since financial resources are generally limited. Traditionally, priorities for conservation of plant species have been focused on endemicity, rarity and particularly on their threatened status. Crop wild relatives (CWR) and wild harvested plants (WHP) are important elements of biodiversity with actual or potential socio-economic value. In this study, eight prioritisation criteria were used along with different prioritisation systems and applied to the Portuguese CWR and WHP. The top 50 species obtained by each of these methods were identified. The final top CWR were those that occurred as a priority in most methods. Twenty CWR were identified as the highest priorities for conservation in Portugal and they include wild relatives of the crop genera *Allium*, *Daucus*, *Dianthus*, *Epilobium*, *Festuca*, *Herniaria*, *Narcissus*, *Quercus*, *Plantago*, *Trifolium*, and *Vicia*. Eighteen WHP were recognised as priorities for conservation and include several *Narcissus* and *Thymus* species, among others. The advantages, limitations and level of subjectivity of each of the methods used in this exercise are discussed.

Keywords Conservation planning · Crop wild relatives · Prioritisation criteria · Ranking systems · Scoring systems · Wild harvested plants

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CHECKLIST AND PRIORITY CWR FOR PORTUGAL

Second iteration of the checklist and of the priority list – what was done differently?

Crop wild relative checklist		
	First iteration (2008-2010)	**Second iteration (2023)**
Geographic scope	Mainland	Mainland + Azores + Madeira archipelagos
People involved	Academic exercise (PhD)	Task Force with 8 experts from the 3 geographic units and from PGR (INIAV), protected areas (ICNF) and academia (UL, UMA, UAC)
Taxonomic scope	• No floristic checklist • 2261 taxa	• Published floristic checklist + online Interactive Flora Online for all 3 geographic units • 2992 taxa (638 Azores, 884 Madeira, 2411 mainland)

CHECKLIST AND PRIORITY CWR FOR PORTUGAL

Second iteration of the checklist and of the priority list – what was done differently?

Priority list of CWR for conservation		
Criteria	8 criteria: native status, economic value of the related crop, global and national distribution, *ex situ* and *in situ* conservation status, legislation, threat status	3 criteria for mainland and Madeira (Kell *et al.* 2017): • Economic category of the related crop: wild relatives related to human and animal food crops (CRITERION 1) • Native status: native taxa to the geographic unit in consideration (CRITERION 2) • Potential use in crop improvement: taxa belonging to GP1B and GP2 or TG1B and TG2, or in GP3 or TG3 and TG4 that have been used as gene donors or have shown promise for crop improvement (CRITERION 3) 2 criteria for Azores: CRITERIA 1 and 2

CHECKLIST AND PRIORITY CWR FOR PORTUGAL

Second iteration of the checklist and of the priority list – what was done differently?

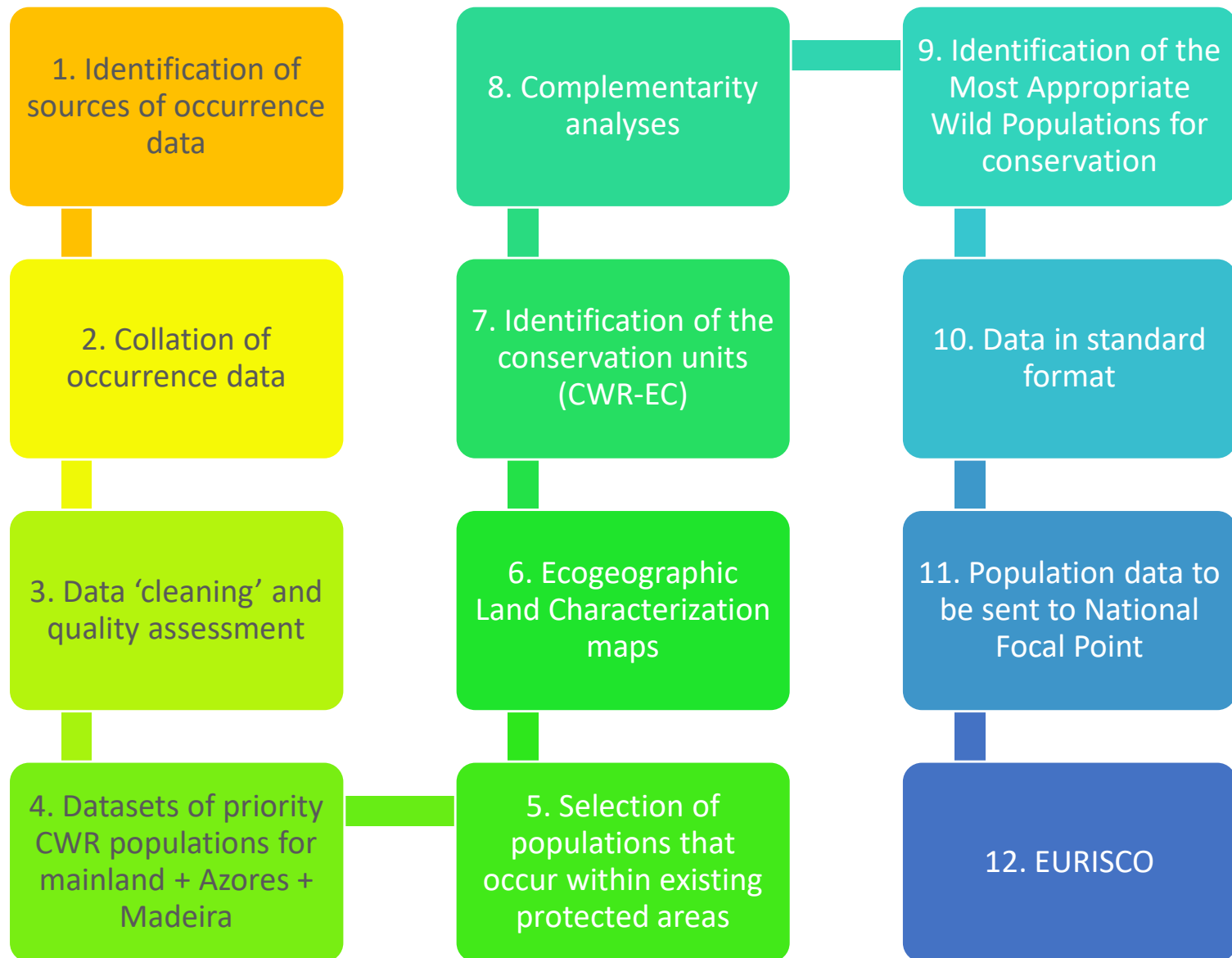| Priority list of CWR for conservation		
Methodology	• Extensive study on criteria and prioritization methods • Applied 4 different methods combining the 8 criteria → those taxa that were present in most of the methods were selected as priorities	• Sequential: CRITERION 1 → CRITERION 2 → CRITERION 3 • Criteria applied to the CWR checklist of each geographic unit • Priority lists discussed with Task Force (e.g. 2 CWR added to the priority list of the Azores)
Priority CWR	20 spp. (20 taxa)	• Azores: 98 → 27 taxa (25 spp.) • Madeira: 241 → 159 → 57 taxa (54 spp.) • Mainland: 504 → 462 → 167 taxa (151 taxa)

PRIORITY POPULATIONS FOR *IN SITU* CONSERVATION AND TO INTEGRATE IN EURISCO

1. Identification of sources of occurrence data

2. Collation of occurrence data

3. Data 'cleaning' and quality assessment

4. Datasets of priority CWR populations for mainland + Azores + Madeira

5. Selection of populations that occur within existing protected areas

6. Ecogeographic Land Characterization maps

7. Identification of the conservation units (CWR-EC)

8. Complementarity analyses

9. Identification of the Most Appropriate Wild Populations for conservation

10. Data in standard format

11. Population data to be sent to National Focal Point

12. EURISCO

PRIORITY POPULATIONS FOR *IN SITU* CONSERVATION AND TO INTEGRATE IN EURISCO

1. Identification of sources of occurrence data

2. Collation of occurrence data

NATIONAL

- BPGV (mainland) (requested)

- IsoPlexis (Madeira) (requested)

- Flora-On (mainland + Azores + Madeira) (requested and downloaded manually)

INTERNATIONAL

- GBIF (R Script)

- Genesys PGR (downloaded manually)

- EURISCO (downloaded manually)

CAPFITOGEN format

PRIORITY POPULATIONS FOR *IN SITU* CONSERVATION AND TO INTEGRATE IN EURISCO
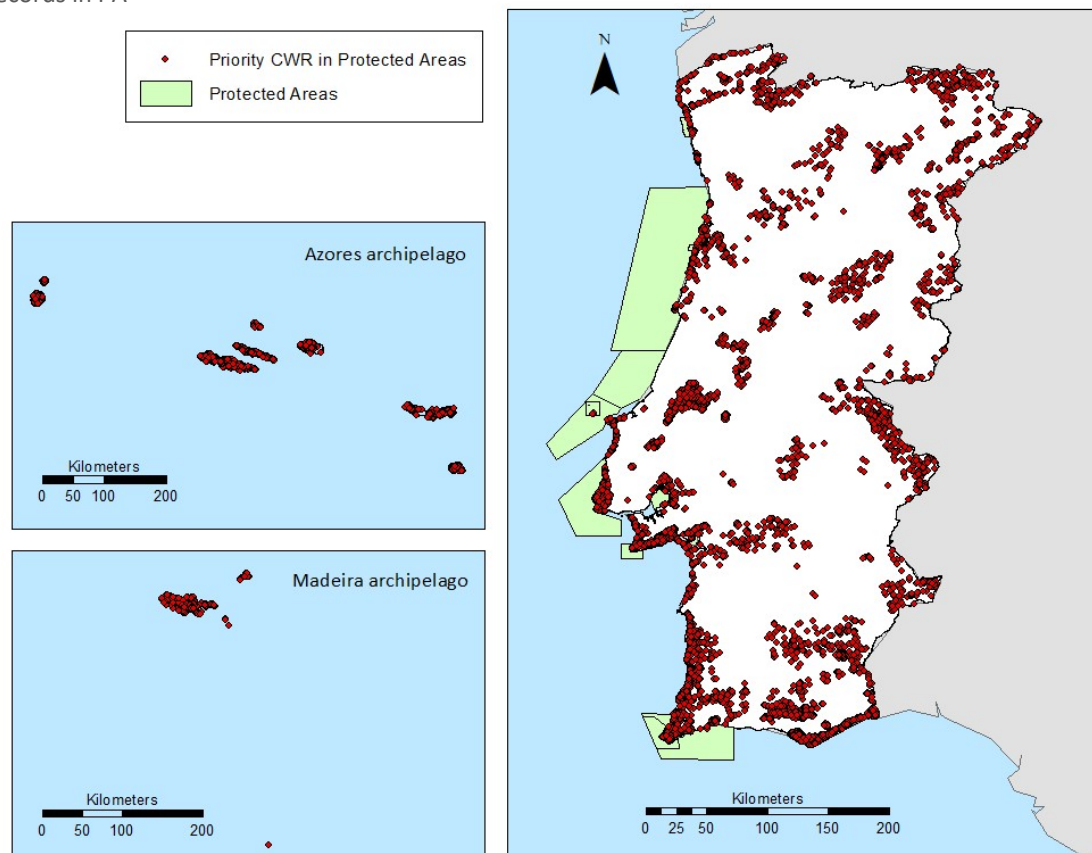
3. Data 'cleaning' and quality assessment

- Removed duplicates (same taxon, lat, long, source)

- Removed records with missing coordinates

- Removed records with imprecise coordinates (i.e., records with zero decimal places for lat OR long; records with only 1 decimal place in lat AND long)

- Removed data older than 1950

- Removed data outside the modelling extent (e.g. in Spain, sea)

- R Script + manually + GEOQUAL (CAPFITOGEN)
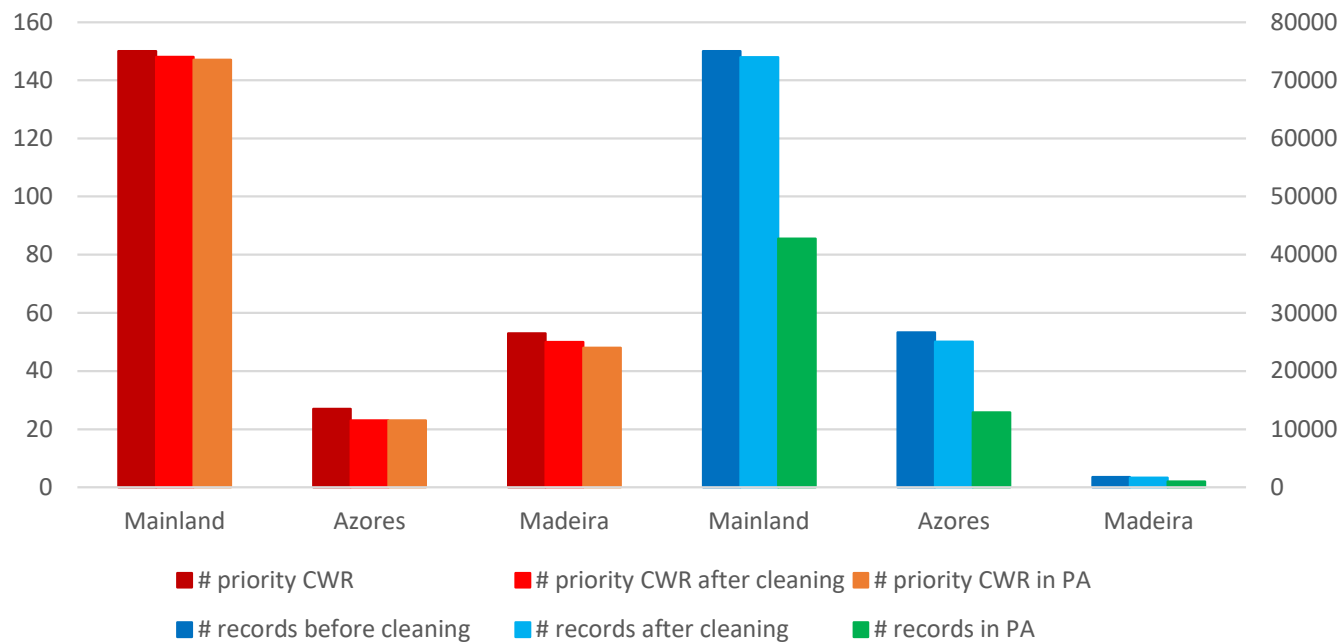
5. Selection of populations that occur within existing protected areas

4. Datasets of priority CWR populations for mainland + Azores + Madeira

Chart legend:
- # priority CWR
- # priority CWR after cleaning
- # priority CWR in PA
- # records before cleaning
- # records after cleaning
- # records in PA

Chart x-axis categories: Mainland, Azores, Madeira, Mainland, Azores, Madeira

Map legend:
- Priority CWR in Protected Areas
- Protected Areas

Azores archipelago

Kilometers
0 50 100 200

Madeira archipelago

Kilometers
0 50 100 200
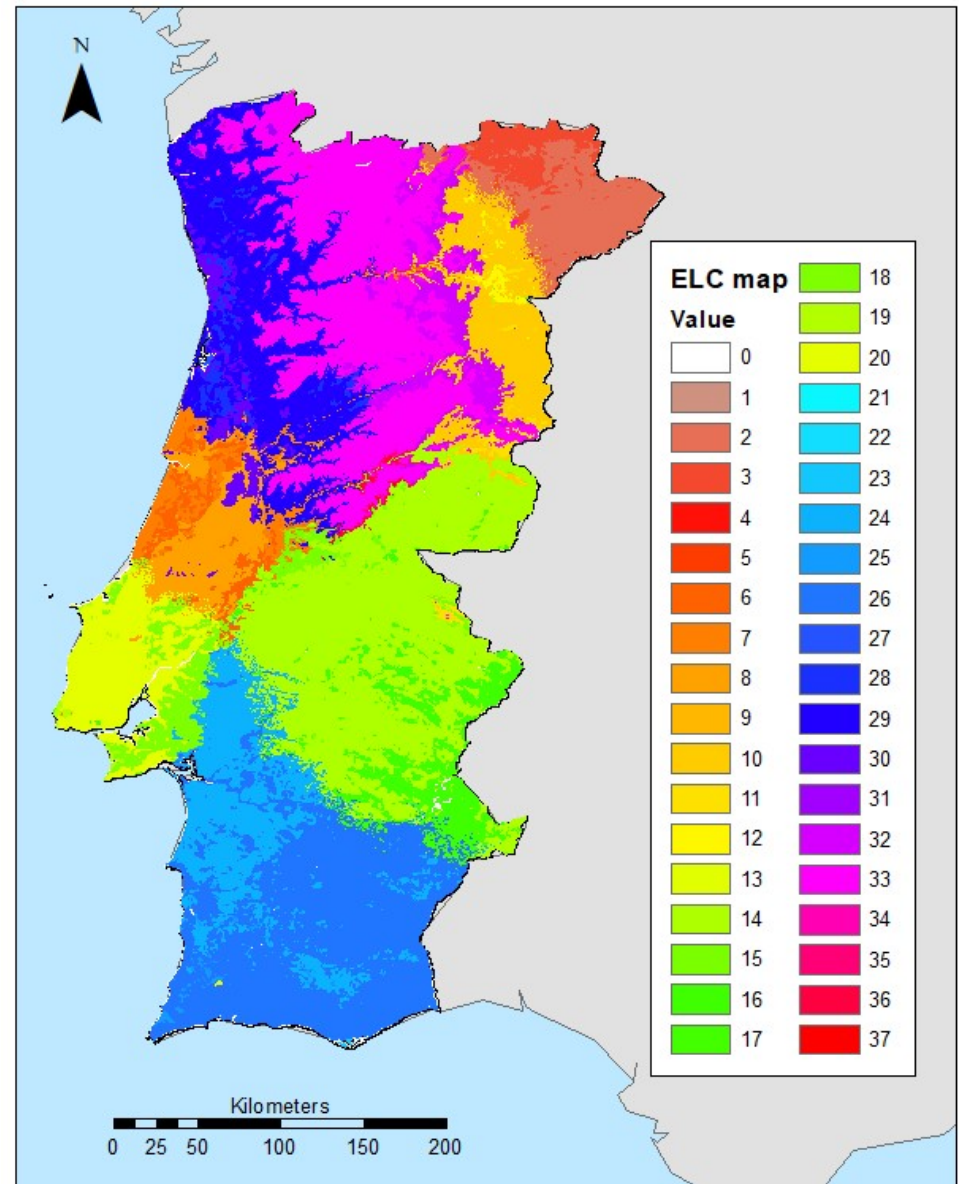
N

Kilometers
0 25 50 100 150 200

PRIORITY POPULATIONS FOR *IN SITU* CONSERVATION AND TO INTEGRATE IN EURISCO

6. Ecogeographic Land Characterization maps

- For each geographic unit (not so accurate for the islands)

- SelecVar + ELCmapas (CAPFITOGEN)

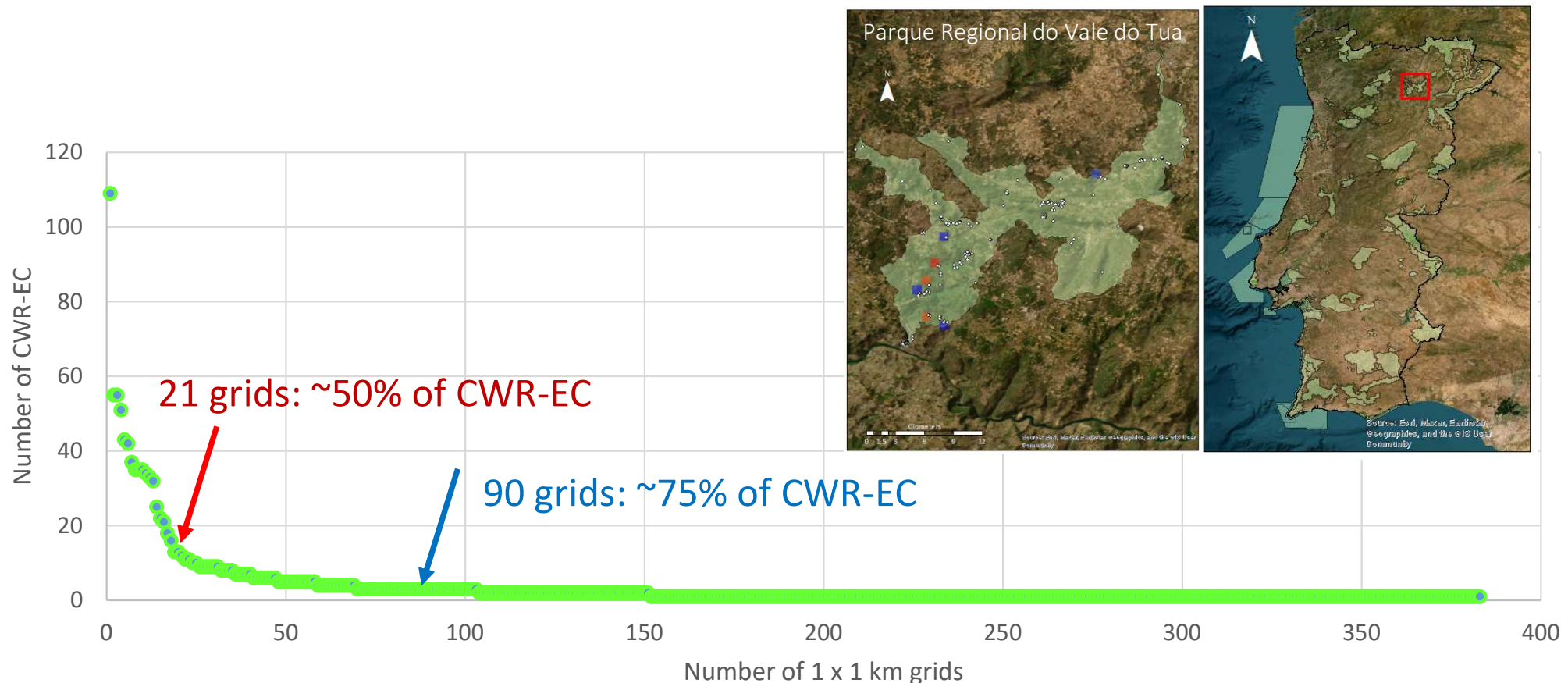**7. Identification of the conservation units (CWR-EC)**

- Overlay CWR distribution + ELC map

- 1,470 CWR-EC (148 priority CWR)

ELC map
Value

0		18	
1		19	
2		20	
3		21	
4		22	
5		23	
6		24	
7		25	
8		26	
9		27	
10		28	
11		29	
12		30	
13		31	
14		32	
15		33	
16		34	
17		35	
		36	
		37	

Kilometers
0 25 50   100   150   200

PRIORITY POPULATIONS FOR *IN SITU* CONSERVATION AND TO INTEGRATE IN EURISCO

8. Complementarity analyses

- Complementa (CAPFITOGEN)

- 383 grid cells 1 x 1 km → 1,470 CWR-EC (148 priority CWR out of 151)

  → 1,470 pop. (~4% of total no. pop in PA)

Parque Regional do Vale do Tua

21 grids: ~50% of CWR-EC

90 grids: ~75% of CWR-EC

Number of CWR-EC

Number of 1 x 1 km grids

PRIORITY POPULATIONS FOR CONSERVATION AND TO INTEGRATE IN EURISCO

9. Identification of the Most Appropriate Wild Populations for conservation

- 5,363 pop. (148 priority CWR):
  - 1,470 pop. [that correspond to the CWR-EC in the 1 x 1 km 383 grids (potential genetic reserves)]
  - 3,893 pop. (all the other pop. of priority CWR that occur in those grids)

10. Data in standard format

- *Template for* In Situ *CWR Passport Data in EURISCO*
- *Principles for the Inclusion of CWR Data in EURISCO* (van Hintum and Iriondo 2022)

11. Population data sent to National Focal Point

- Filomena Rocha (INIAV)
- 18 December 2023

12. EURISCO

- Data not yet sent to EURISCO due to difficulty in assigning ACCENUMB

CHALLENGES AND WHAT WE WOULD LIKE TO DO NEXT

- To obtain feedback from the Task Force regarding the CWR checklist and priority lists.

- To obtain the occurrence data from the main database of Portuguese plant populations, Flora-On (https://flora-on.pt/).

- To find accurate ecogeographic data for the Azores and Madeira archipelagos.

- Re-run the conservation planning analyses with the Flora-On data: additional CWR MAWP may be identified and incorporated into EURISCO.

- Run the conservation planning analyses with accurante ecogeographic data for the Azores and Madeira archipelagos: CWR MAWP will be identified and incorporated into EURISCO.

- Predict the impact of climate change on priority CWR populations and identify those that are not predicted to be affected by climate change: these are more likely to be available for utilization in the future.

- Organize better and formally the network of data providers and the formal access to the populations.

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THANK YOU!