CROP WILD RELATIVES WG REPORT FOR PHASE X (2019-2023)

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1. CONTRIBUTION TO ECPGR OBJECTIVES

1.1. Achievements and success stories

Red List Global and regional assessments: we submitted 99 assessments of global priority CWR taxa to add to the ≈1,000 global priority CWR and a further 150 other CWR taxa assessments were drafted. At the national level, in Spain, an addendum to the National Red Data Book was published (Moreno Saiz et al., 2019) where two further CWR were assessed and included, *Allium grosii* Font Quer and *Erodium paularense* Fern. Gonz. & Izco.

Conservation planning

Planning the design of the European network for the *in situ* conservation of CWR was initiated and almost finalised within the Farmer's Pride project (www.farmerspride.eu); within this context, the importance of the Natura 2000 sites for the conservation of CWR in Europe was studied and highlighted (Kell *et al.*, 2019) and a European analysis of priority CWR distribution and identification of candidate locations for the establishment of genetic reserves for the active *in situ* conservation of populations was undertaken (Rubio Teso *et al.*, 2021). The foundations of the network were laid (https://more.bham.ac.uk/farmerspride/wp-content/uploads/sites/19/2021/04/Farmers_Pride_Network_Concept_English.pdf), and a coalition of support for its establishment was initiated (see https://more.bham.ac.uk/farmerspride/network/).

In 2019, the project Wild Genetic Resources–A Tool to Meet Climate Change (a follow-up of the project Ecosystem Services: Genetic Resources and Crop Wild Relatives) came to an end. The project, funded by the Nordic Council of Ministers and by self-funding from the participating organisations, involved partners from all the Nordic countries. The project activities and results are summarised in a report published by the Nordic Council of Ministers [Palmé, *et al*., 2019). Within this project, the Nordic European network of genetic reserves for regionally important CWR was designed and published [Fitzgerald, H. *et al.*, 2019).

The Finnish CWR conservation project, funded by the Finnish Ministry of Agriculture and Forestry, started in 2019. The main project partners are the Natural Resources Institute Finland (Luke), the Finnish Museum of Natural History (Luomus) and Metsähallitus Parks and Wildlife Finland. Several activities were carried out: second iteration of the list of priority CWR, *ex situ* and *in situ* conservation planning and inventorying CWR species in a pilot site (Nuuksio National Park).

Considerable progress in CWR conservation in Germany was achieved in 2019, namely the establishment of the German Network of Genetic Reserves for CWR conservation, the Wild Celery Genetic Reserves Network, and a list of national priority CWR agreed in a national symposium on genetic reserves: (a) *German Network of Genetic Reserves*: it was established in 2019 as a framework for the *in situ* conservation of priority CWR. It is coordinated by the Federal Office for Agriculture and Food (BLE). The *in situ* conservation of CWR is addressed by the German National Agrobiodiversity Strategy (BMELV 2007) and the National Programme for Plant Genetic Resources for Food and Agriculture (BMEL 2012). (b) *Wild Celery Genetic Reserves Network*: the first thirteen genetic reserves for wild celery

species were established and further wild celery genetic reserves are in the process of being established. This network is managed by the Julius Kühn-Institut Federal Research Centre for Cultivated Plants. The establishment of this network was the result of a three-year project financed by the German Federal Ministry for Food and Agriculture and is part of the German Network of Genetic Reserves that has been established in 2019 in Germany as a framework for *in situ* conservation of priority CWR. The *in situ* conservation of CWR is an area of PGRFA conservation, which the German national agrobiodiversity strategy (BMELV 2007) and the National Programme for PGRFA (BMEL 2012) clearly address as one important field of action; (c) further CWR specific networks that will become part of the *German Network of Genetic Reserves* were at various stages of development. For example, 27 areas (nine fen meadows, nine oat grass meadows and nine calcareous grasslands in southwest Germany–Swabian Alb and Alpine foothills in Baden-Württemberg) were proposed as genetic reserves as a result of the project Identification and Conservation of Historic Old Grasslands, financed by BMEL. Another example is the series of research projects financed by BMEL on wild grapevine in the Rhine floodplains where progress has been made to establish a wild grapevine network. The most important wild grapevine site harbours the only naturally rejuvenating wild grapevine population in Germany on the Rhine island Ketsch (Nick 2014). In June 2019, the agricultural and nature protection sectors (BMEL, BLE, JKI, the Federal Agency for Nature Conservation (BfN) and other partners) jointly organised the symposium *Genetic Reserves for Wild Plants for Food and Agriculture – a New Module to Strengthen Species Protection*, held at JKI. The results of the Wild Celery Genetic Reserves project were presented, as well as results and experiences from other comparable projects (e.g. wild grapevine, wild fruit trees and grassland species). At this symposium, a working list of priority CWR was developed involving experts and the nature conservation sector. This list contains 126 taxa, of which 44 are considered higher priority.

In Lithuania advances were made to establish a national network of genetic sites of CWR together with medicinal and aromatic plants (Labokas and Karpavičienė, 2020). While in the Czech Republic, the Hop Research Institute made a preliminary proposal for active conservation of populations of wild *Humulus lupulus* in the Jeseníky Mts. Protected Landscape Area. Also selected localities of critically threatened and/or important CWR were monitored with the aim to propose to plan for their *in situ* conservation. While in Sweden, a National CWR conservation plan was published for Sweden (Weibull and Phillips, 2020).

A paper describing five tools that were developed to guide and facilitate countries in CWR national conservation planning and in developing National Strategic Action Plans for the Conservation and Sustainable Use of CWR was published by Magos Brehm *et al.* (2019).

Policy

In 2019 to aid CWR Conservation policy development, a design of the European network for the *in situ* conservation of CWR was initiated and its governance structure drafted and discussed among major national and regional stakeholders. A stakeholder consultation document on the *Farmer's Pride* network concept was drafted and shared among national stakeholders who are the ultimate implementing agencies of the European network.

A call for policymakers to work with *Farmer's Pride* and other stakeholders to ensure adequate policies are in place for *in situ* conservation and sustainable use of plant genetic resources in Europe was published and sent to relevant stakeholders in European countries (see https://more.bham.ac.uk/farmerspride/wp-content/uploads/sites/19/2020/03/Farmers_Pride_policy_brief_English.pdf). Further, a policy brief about CWR conservation in the Nordic countries was published (Palmé *et al.*, 2019).

A policy roundtable on the establishment of a European network for *in situ* conservation and sustainable use of plant genetic resources was held as part of Session 4 of the *Farmer's Pride* final dissemination conference (https://farmerspridеconference.org/) that took place between 28th June and 1st July 2021. The proposal to promote and embed the European network for *in situ* conservation of plant genetic resources within a European policy framework for genetic resources conservation and sustainable use was discussed. Additionally, the roundtable aimed to provide the conference participants with a clear view of prospects for the network in terms of its long-term recognition in policy and legislation, from local to global levels (see Kell *et al.,* 2021).

Conservation actions

Ex situ conservation of European CWR diversity in gene banks was led by the global project, (*Adapting Agriculture to Climate Change–Collecting and Protecting the Wild Relatives of the World's Most Important Food Crops to Safeguard our Future Food Security in a Changing Climate*) that aimed at collecting seeds of CWR for *ex situ* conservation and pre-breeding activities. In 2019, the collecting phase of the project concluded. Over 6 years, project partners were in the field for a combined 2,973 days, in 25 countries all over the world, to collect and safeguard 4,644 seed samples of 371 different species of CWR. Many species were collected multiple times – on different continents, in different countries and in different regions within a country; capturing and conserving as much diversity as possible both within and among species was at the core of this global collecting effort. CWR seed samples collected during the project were conserved in the national gene bank of the partner country, and also shipped to the Royal Botanic Gardens Kew's Millennium Seed Bank.

In Belarus, 117 samples of CWR species were deposited in the national gene bank totalling more than 1,000 samples of CWR taxa.

In Finland, collecting missions of CWR accessions for *ex situ* conservation took place in 2019 and the material collected was conserved at the seedbank of the Finnish Museum of Natural History (Luomus). Additionally, the national plant genetic resources programme coordinated by the Natural Resources Institute Finland (Luke) conducted surveys, inventories and evaluations in many berry and fruit plants, vegetables, hops and herbs, and in other Nordic countries, NordGen planned and organised seed sampling and collecting missions for forage wild relatives. In 2020 Finland took practical steps to establish a CWR genetic reserve in a pilot *in situ* conservation area (Nuuksio National Park) that contains a potential future CWR genetic reserve site, were defined and the plan for the National CWR network was prepared (Fitzgerald *et al.* 2020).

While Germany in 2022 the national wild celery network was bolstered with five additional reserves, making 20 genetic reserves established.

In 2022 in Norway, the *Nordic CWR* project identified the Færder National Park as an area of interest to actively conserve CWR. Crop wild relatives are recognized in the management plan of the Færder National Park, and there are ongoing discussions to formally establish the area as a genetic resource conservation area. The Nordic CWR network (www.nordgen.org/CWR) provides the support to the continued collaboration and dialogue between researchers, governmental institutions and national park management in Færder. The established collaboration has resulted in the additional funding of a local project, development of information material and continuous dialogue about the implementation of conservation actions. Also the four-year (2021–2024) Nordic CWR project *Conservation and Sustainable Use of Genetic Resources in the Nordic Countries* (https://www.nordgen.org/en/projekts/crop-wild-relatives/), funded by the Nordic Council of Ministers which involves all five Nordic countries (Denmark, Iceland, Norway, Sweden, and Finland, including the autonomous Finnish

region of Åland), has been successfully implemented during the first two years, and substantial progress has been made. During 2022, activities included climate change modelling of geographic distribution of CWR under different climate scenarios, analysis of genetic diversity in selected CWR, inventory of CWR in protected areas, collection of seeds for long-term storage in gene banks, and communication activities. In the Nordic CWR project, seeds of CWR were collected in 2021 and 2022 for long-term conservation at NordGen, the Nordic Genetic Resource Centre (https://www.nordgen.org/), and made available to users. During 2022, collections were made in Denmark (8 accessions, 6 species), Finland (9 accessions, 7 species), Iceland (3 accessions, 2 species), Norway (9 accessions, 7 species), Sweden (20 accessions, 20 species from Skåne; 10 accessions, 4 species from Norrbotten).

The tool 'Crop wild relatives in European protected areas: A tool for protected area managers' (https://www. ecpgr.cgiar.org/crop-wild-relatives-in-natura-2000) was developed to help protected area managers identify which CWR are likely to occur in the protected areas they manage. The 'Web Tool for CWR Population Management' (https://cwrpopulation-toolkit.cropwildrelatives.org/) was prepared to provide practical guidelines for the management of CWR populations *in situ* and the sites in which they are being conserved.

A manual for a potential benefit-sharing mechanism for CWR that is associated with the adaptation of payment for ecosystem services (PES) to support CWR conservation and sustainable use was developed (Drucker *et al.* 2022). In Spain, the National Strategy for Conservation and Utilization of Crop Wild Relatives (CWR) and Wild Food Plants (WFP) was published on the 18th November 2022. It can be accessed at: https://www.mapa.gob.es/es/agricultura/temas/medios-de-produccion/mapa_estrategiadeconservacion_04_tcm30-636650.pdf.

In Spain, the National Strategy for Conservation and Utilization of Crop Wild Relatives (CWR) and Wild Food Plants (WFP) was developed in a participatory process in the period 2019-2021, approved by the Ministry of Agriculture in July 2022 and published in November 2022. It can be accessed at: https://www.mapa.gob.es/es/agricultura/temas/medios-de-produccion/mapa_estrategiadeconservacion_04_tcm30-636650.pdf. Furthermore, the project "*Ex situ and in situ conservation of crop wild relatives in the Biosphere Reserve of Sierra del Rincón*" (2019-2021) was funded by the Regional administration of Madrid and implemented by Universidad Rey Juan Carlos and Banco de Germoplasma Vegetal 'César Gómez Campo' of Universidad Politécnica de Madrid. The main objective of this project was the establishment of the first set of genetic reserves for nationally important CWR. Three of them were established on public land and another three on private farming land. Management plans including a monitoring program were developed and published with the active participation of their owners.

1.2. Gaps or constraints identified

It remains noticeable that the report section detailing work on planning CWR conservation is substantially longer than the section on CWR conservation action. A review of CWR conservation cannot fail to conclude that the science of CWR conservation has advanced significantly in recent years, but although the theory of CWR diversity maintenance has progressed, most European countries are actively planning CWR conservation, but as yet there is limited progress with practical implementation, only a handful of countries have established CWR genetic reserves and none of these meet the minimum population management standard proposed by Iriondo *et al.* (2012).

It can also be argued that CWR contain the greatest range of diversity and therefore offer the best opportunity to supply the required novel diversity required by breeders. Yet one of the barriers to incorporating novel diversity into breeder's material is the breeders

themselves, some comment they already have sufficient diversity in their breeding programmes and are put off using CWR material because of associated linkage drag. Linkage drag being the transfer of deleterious traits along with the target beneficial traits from the CWR to the crop, that then requires extensive back-crossing with the crop material to eliminate (Maxted *et al.*, 2020). Consequently, some breeders today may still feel working with CWR is not worth the effort. However, the impact of climate change is leading breeders to search more regularly for novel traits outside of their own collections (McCouch et al., 2013; Dempewolf & Guarino, 2015). Further, the fact that substantial funds are being devoted to the provision of pre-breed lines that already contains beneficial CWR traits for farmer and breeder usage (https://www.croptrust.org/work/projects/the-bold-project/#c4667; Dempewolf *et al.*, 2017), the increased ease of access to CWR germplasm (Kilian *et al.*, 2021; Eastwood *et al.*, 2022) and the rapid progress in gene editing techniques (Hartung & Schiemann, 2014; Wang *et al.*, 2022) are reducing the 'unitarization cost' of linkage drag and are making the breeder's reluctance to use CWR diversity less justifiable. The limited progress in CWR conservation action and breeders use has recently been reviewed by Maxted and Magos Brehm (2023), which highlihts the recent advances in CWR science and re-argues the case for greater breeders use of CWR diversity.

It is noticeable that the CGIAR have at least partially addressed these issues through (a) more systematic *ex situ* sampling and conservation, (b) CG genebanks active engagement in predictive characterisation of CWR material to meet specific trait demand by breeders and consumers, and (c) CWR-based pre-breeding in collaboration with CG and National Agricultural Research Centre's breeders (Lusty *et al.*, 2021). However, this approach ignore two key issues, (d) *in situ* (on-farm) based CWR conservation and (e) national CWR conservation. It is well recognised that *ex situ* seed-based conservation halts evolutionary adaptation, known to occur naturally and often rapidly *in situ* and therefore *ex situ* conservation should not be the only or preferred approach used, particularly given the sheer numbers of CWR species involved and the need to conserve multiple populations of each CWR species, therefore to maximize genetic diversity conserved the *ex situ* option alone can not succeed. To achieve this goal a complementary approach involving active *in situ* and *ex situ* conservation is required.

Given the knowledge gained from the Farmer's Pride project across Europe, and the efforts of the ECPGR CWR WG, the resistance to *in situ* methods is crumbling, at least to the theoretical application of *in situ* conservation techniques. However, practical application has an additional cost and involves a larger number of cross community collaborators. It is just more complicated to set up a CWR genetic reserve than collect a seed sample, so in retrospect it is not surprising the transition from theory to practice has taken time.

Another issue is that of the funding source, CWR *in situ* conservation in Europe has come primarily from the European Commission (EC FP5 PGR Forum, 2002; EC FP6 DIVERSEEDS, 2006; EC GEN RES AEGRO, 2006; EC FP6 PGR Secure, 2011; EC H2020 Farmer's Pride, 2018). But by definition *in situ* conservation occurs at the national level, all CWR populations exist at a particular location that is ultimately managed by governmental edict. Therefore, the EC funded projects have logically focused more on European networking activities and failed to note the major costs that are borne nationally where CWR are located. There is a need to retarget national CWR conservation to ensure adequate *in situ* conservation.

These projects have focused on European networking activities and it was largely assumed national PGR programmes would follow and implement regional recommendations, it should be acknowledged that this approach has not entirely worked. There needs to be a much clearer focus on national CWR planning and implementation to help ensure national government prioritise the necessary resources to implement actions. This is a key component

of the current *Effective and efficient conservation and use of crop wild relative (CWR) genetic diversity to sustain European agriculture (EURO CWR)* application for Horizon Europe – Work Programme 2023-2024 Food, Bioeconomy, Natural Resources, Agriculture and Environment – funding. Therefore, European CWR conservation gaps and constraints have been identified, but there is a substantive plan to fill these gaps and overcome the constraints identified.

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2. GRANT SCHEME ACTIVITIES, WG MEETINGS AND EVA ACTIVITIES

- **Grant Scheme proposals (submitted:1; approved:1 (July 2019))**
  Identification, preparation of applications and approval of sites to join the European *in situ* PGRFA conservation network (Inclusion of CWR sites in European *in situ* network) (1st call)

A joint workshop was held together with Farmer's Pride project focused on two major topics:

1. Standards and procedures for CWR and LR sites/populations (Discussion Session 1) and
2. Network governance, policy, advocacy and communications (Discussion Session 2).

The work took place in six subgroups dealing with three different subtopics in each session, respectively. A wide spectrum of questions was covered during the discussions – from inclusion criteria and management standards for CWR and LR sites/populations to communication requirements to engage Network stakeholders. Draft timelines with concrete steps were proposed to take forward all the major procedures as well as draft recommendations were developed to facilitate Network creation. For details follow the link to the Final Activity Report (2021) below.

- **Total number of partners involved in Grant Scheme: 10 from 10 countries**
  - ECPGR-funded: 10 from 10 countries
  - Self-funded: None

- **Meetings held**
  - First meeting of the Activity 'Inclusion of CWR sites in European *in situ* network', 8-10 October 2019, Santorini, Greece.
  - Ad hoc Crop Wild Relatives Working Group meeting, 13–15 December 2022, Thessaloniki, Greece.

- **Total number of partners involved in WG meeting: 37 from 24 countries**
  - ECPGR-funded: 18 from 16 countries
  - Self-funded: 3 from 3 countries

- **Reports and related data**
  'Inclusion of CWR sites in European *in situ* network' Final Activity Report (2021)
  Minutes of the CWR in EURISCO Coordination meeting, 15 December 2022, Thessaloniki, Greece (2022)

- **Funds mobilized**
  - ECPGR granted funds: € 15,000

- Inputs in-kind declared in Grant activities: None
- Working Group meeting: € 12,600

3. OTHER ACTIVITIES (CROSS-WORKING GROUP ACTIVITIES, LINKS WITH OTHER NETWORKS, INTERNATIONAL PROJECTS AND INITIATIVES)

- **Cross-Working Group activities**: The CWR WG is a thematic network so by definition must work with other ECPGR *Crop-based* and the *Documentation and Information* WGs. Therefore, the CWR WG activities can only succeed if we are working together with the Crop WGs and each activity will have a documentation and information component – cross WG activities are both inevitable and desirable. To illustrate collaboration the recent Horizon Europe funding application, EURO CWR, involved 34 partners and they collective represent 23 of the 30 ECPGR WG. However, the CWR WG is conscious to ensure we do not dictate WG actions and maintain an active dialogue with the members of other WG, therefore ensuring our continued relevance to leading CWR science and more general PGR conservation and use in Europe. Another example of cross-working group activity is the participation in the project "Extension of EURISCO for Crop Wild Relatives (CWR) *in situ* data and preparation of pilot countries' data sets" coordinated by ECPGR Secretariat, funded by the German Federal Ministry of Food and Agriculture, and with involvement of the ECPGR Documentation and Information Working Group and the EURISCO Advisory Committee.

- **Others:** Through its members the CWR WG is actively engaged in CWR science development CWR conservation for the Europe continent, each European country and as part of global initiatives, these include active collaboration with:
  - Commission on Genetic Resources for Food and Agriculture;
  - International Treaty on PGRFA;
  - Consultative Group for International Agricultural Research;
  - Crop Trust;
  - IUCN SSC Crop Wild Relative Specialist Group;
  - IUCN SSC Conservation Planning Specialist Group;
  - IUCN Plant Conservation Committee;
  - International Association of Plant Taxonomists;
  - EUROSEEDS;
  - EUROSITE;
  - Specific international research projects:
    - Adapting Agriculture to Climate Change–Collecting and Protecting the Wild Relatives of the World's Most Important Food Crops to Safeguard our Future Food Security in a Changing Climate – Crop Trust
    - Bridging agriculture and environment: Southern African crop-wild-relative regional network – UK Darwin Initiative project (Project # 26-023)

4. WORKING GROUP DOCUMENTS AND PUBLICATIONS

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5. EXPECTED ADDITIONAL ACHIEVEMENTS AND FUTURE ACTIVITIES THAT COULD CONTRIBUTE TO THE IMPLEMENTATION OF THE PGR STRATEGY FOR EUROPE

The EC recently released a call for a CWR project with a budget of 12M euro – HORIZON-CL6-2023 –BIODIV-01-13: Crop wild relatives for sustainable agriculture (Deadline 28.3.23). The ECPGR CWR WG submitted an application led by the WG Chair - *Effective and efficient conservation and use of crop wild relative (CWR) genetic diversity to sustain European agriculture (EURO CWR)*. So if the application is successful the consortium will be able to fill the gaps and overcome the constraints identified that are restricting CWR conservation and use in Europe.