

## New EUCARPIA partnership in EU FP7 collaborative project



Novel characterization of crop wild relative and landrace resources as the basis for improved plant breeding

[www.pgrsecure.org](http://www.pgrsecure.org)

Coordinator: Dr. Nigel Maxted, University of Birmingham, UK

Project Manager: Ms. Shelagh Kell, [s.kell@bham.ac.uk](mailto:s.kell@bham.ac.uk)

The EC Biodiversity Action Plan for Agriculture (COM/2001/0162) concluded that there was a need in Europe for a step change in crop cultivar production because of rapidly changing consumer demands and the need to ensure food security within the continent; particularly in the light of the impacts of climate change. If these requirements are to be met, plant breeders need a broader pool of diversity to supply the necessary range of mitigating traits, as well as greater characterization and evaluation efficiency to locate the desired traits. The Action Plan also argued that maintaining the *status quo* for agrobiodiversity conservation and use is no longer tenable and that a step change in systematic conservation and use is required. The two major components of agrobiodiversity that offer the broadest range of diversity for breeders are crop wild relatives (CWR) and landraces (LR) but there is currently a gap between the conservation and use of these resources and they are under-exploited by the user community. In order to meet the needs of future generations, there are five key areas that need to be addressed:

1. *Climate change mitigation* – The adverse impacts of climate change (such as extreme weather events) on patterns of crop diversity and local cultivar adaptation are predicted to have a negative impact on crop yields. Breeders will be increasingly required to take adaptive action—breeding for example novel drought, pest and disease resistant cultivars—which will require extensive screening of genetic resources and use of adaptive traits in breeding resistant cultivars.
2. *Limited success of traditional characterization to meet breeders' needs* – Traditional phenotypic characterization and evaluation using field trials is resource intensive—the vast majority of conserved CWR/LR accessions remain uncharacterized and as a direct result largely unutilized. Novel approaches to characterization beyond those previously applied are required to extend the use of CWR and LR diversity.
3. *Lack of systematic CWR and LR conservation* – Within European *ex situ* germplasm collections, only a very small percentage of germplasm holdings are CWR species and these are not a

representative sample of the genetic diversity found in European populations. Although the numbers of gene bank holdings of LR are undoubtedly greater, without an inventory or conservation strategy it is unknown if these holdings truly reflect the diversity still maintained by farmers today in Europe, and which could potentially be made available to breeders. There is also currently no active *in situ* conservation of CWR in Europe as these species tend to fall between the priorities of the PGRFA conservation and nature conservation communities.

4. *Threats facing CWR and LR diversity* – It is recognized worldwide that biodiversity is currently under severe threat from a range of deleterious factors (e.g., habitat destruction, degradation and fragmentation, over-exploitation, invasive alien species and changes in land management), but that climate change is likely to be a degree of magnitude more catastrophic in terms of loss of species and genetic diversity. It is difficult to quantify the threats facing CWR and LR diversity within Europe as it has yet to be directly studied, but if the threat to wild plant species can act as a proxy, then CWR and LR diversity is likely to be severely threatened, particularly as CWR are likely to suffer extinction at similar rates to other wild species but will also suffer genetic erosion of the locally adapted diversity required by breeders.
5. *Lack of plant genetic resource informatics cohesion* – In recent years there has been significant informatics development within the European PGRFA community. The *European Cooperative Programme for Plant Genetic Resources* (ECPGR – [www.ecpgr.cgiar.org](http://www.ecpgr.cgiar.org)) crop networks developed the *European Central Crop Databases* (ECCDB – [www.ecpgr.cgiar.org/germplasm\\_databases/central\\_crop\\_databases.html](http://www.ecpgr.cgiar.org/germplasm_databases/central_crop_databases.html)) that contain accession passport, characterization and evaluation data for major crop collections; the ECPGR *Documentation and Information Network* through the FP5 consortium EPGRIS developed the EURISCO Web catalogue of *ex situ* gene bank holdings (<http://eurisco.ecpgr.org/>), and the ECPGR *In situ and On-farm Conservation Network* ([www.ecpgr.cgiar.org/networks/in\\_situ\\_and\\_on\\_farm.html](http://www.ecpgr.cgiar.org/networks/in_situ_and_on_farm.html)) through the FP5 consortium PGR Forum ([www.pgrforum.org](http://www.pgrforum.org)) developed the Crop Wild Relative Information System (CWRIS – [www.pgrforum.org/cwr/cwr.asp](http://www.pgrforum.org/cwr/cwr.asp)) containing a nomenclatural checklist and basic biodiversity data for European CWR species. However, each system currently stands alone and there is a need to link these systems into one comprehensive information portal for European PGRFA. Furthermore, vast quantities of data on gene sequences are continually expanding in world databases and transcriptomic information is close behind. Effective CWR/LR diversity conservation and use requires advanced informatic techniques to join up all these information systems and the data they contain.

The FP7 collaborative project, PGR Secure was initiated by the ECPGR *In Situ* and On-Farm Conservation Network with the aim of addressing these issues and advancing CWR/LR diversity conservation and use. The goals of PGR Secure are therefore to research novel characterization techniques for CWR and LR, develop conservation strategies for European CWR and LR diversity, and to enhance crop improvement by breeders as a means of underpinning European food security in the face of climate change. To achieve these goals PGR Secure has four research themes: 1) novel characterization techniques, 2) CWR and LR conservation, 3) improved use of CWR and LR by breeders, and 4) informatics (Figure 1). Themes 1 and 3 address how to improve breeders' use of conserved CWR / LR diversity by applying novel characterization techniques such as genomics, transcriptomics, metabolomics, high-throughput phenotyping and GIS-based predictive

characterization, as well as clarifying through dialogue exactly what breeders need to bridge the conservation–use gap and facilitating the flow of selected material and knowledge from the project to the breeder community. Theme 2 enhances CWR and LR species and genetic diversity conservation through development of CWR and LR inventories and systematic conservation strategies, while Theme 4 addresses the management and provision of access to CWR and LR conservation and trait information.

The PGRFA user community in Europe is diverse; ranging from breeding companies, public research institutes, gene banks, non-governmental organizations (NGOs), universities and farmers, but it is use by plant breeders that has potentially the greatest economic and social benefit in Europe. FAO’s Second Report on the State of the World’s Plant Genetic Resources for Food and Agriculture ([www.fao.org/agriculture/crops/core-themes/theme/seeds-pgr/sow/sow2/en/](http://www.fao.org/agriculture/crops/core-themes/theme/seeds-pgr/sow/sow2/en/)) highlights that “Considerable opportunities exist for strengthening cooperation among those involved in the conservation and sustainable use of PGRFA, at all stages of the seed and food chain. Stronger links are needed, especially between plant breeders and those involved in the seed system, as well as between the public and private sectors”. The PGR Secure project seeks to strengthen these links and involves collaboration between European policy, conservation and breeding sectors throughout Europe.

For further information, please visit the project website: [www.pgrsecure.org](http://www.pgrsecure.org) or contact the Project Manager, [s.kell@bham.ac.uk](mailto:s.kell@bham.ac.uk).

**Figure 1.** Schematic diagram of interrelated PGR Secure project themes

