

SECTION A. CROP WILD RELATIVES

A.1. Introduction

What are crop wild relatives?

Crop wild relatives (CWR) are taxa closely related to crops and are defined by their potential ability to contribute beneficial traits for crop improvement; for example, to confer resistance to pests and diseases, improve tolerance to environmental conditions such as extreme temperatures, drought and flooding, and to improve nutrition, flavour, colour, texture and handling qualities. A working definition of a CWR based on the Gene Pool concept or, in the absence of crossing and genetic diversity information, the Taxon Group concept¹, has been proposed:

“A crop wild relative is 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”.



Pyrus salicifolia Pall., a wild relative of pear (*P. pyraster* Burgsd.), in Naxcivan, Azerbaijan. This species grows in very dry and rocky areas; in some places the seeds of *P. salicifolia* are used to obtain the rootstock for local varieties of pears (photo: Mirza Musayev).

Genetic erosion is a key problem for CWR. What is genetic erosion?

Genetic erosion is a fundamental problem for CWR and has been referred to in the literature as the permanent reduction in richness (total number of alleles) or evenness (i.e. spread of allelic diversity)³ of common local alleles, or the loss of combinations of alleles over time in a defined area⁴. Genetic erosion can affect wild populations conserved *in situ* and *ex situ* collections (i.e. when the *ex situ* collection goes through the regeneration process and are inadvertently selected to suit the regeneration site). It is important to distinguish genetic changes that are

³ Ford-Lloyd (2006)

⁴ Maxted and Guarino (2006)

detrimental to populations from the 'normal' background levels of change⁴. Any loss of genetic erosion means the individual is less likely to be able to adapt to their changing environment and means potentially useful traits are unavailable to the breeder.

Why are CWR threatened?

There are numerous factors that negatively impact wild plant populations resulting in genetic erosion, and potentially eventual loss (extinction) of taxa (varieties, subspecies, and species).

The main factors that contribute to the genetic erosion of CWR diversity include:

- Expansion of the human population (which leads to the unequal and unsustainable use of natural resources, and is the basis of all other threats);
- Climate change which is expected to directly affect the cropping patterns and extinction of wild plant species, particularly in drier regions where certain CWR may already be at the edge of their distribution;
- Habitat destruction, degradation, homogenisation and fragmentation;
- Changes in agricultural practices, soil and land use;
- Use of pesticides and herbicides;
- Over-exploitation (excessive extraction from the wild of timber, fuel wood, medicinal and horticultural plants, overgrazing, excessive tourism, etc.);
- Introduction of exotic species (weeds, pests and diseases that compete with, hybridise with, cause physical or biological damage to, or kill native species);
- Natural calamities (floods, landslides, soil erosion, etc.);
- Lack of education and awareness of the importance of CWR and the need to conserve them;
- War and political instability;
- Lack of conservation action for CWR;
- Environmental mismanagement.



Habitat of *Beta macrocarpa* Guss (a wild relative of beet, *B. vulgaris* L.) in Ria Formosa (Portugal), negatively affected by short and long term threats. Short-term threats include changes in the hidrological regime and the sediments dynamics associated with it, as well as habitat destruction caused by tourism infrastructure, leisure and recreational sailing. Long-term threats include sea level rise and intense and long storms which may cause the disruption and destruction of the barrier islands of the lagoon system where the habitat occurs (photo: Maria Cristina Duarte).

What are the practical consequences of CWR genetic erosion?

- A decline in the short- to medium-term viability of individuals and populations;
- A reduction in the evolutionary potential of populations and species;
- Loss of genetic diversity implies inability to adapt to the changing environmental conditions;
- A decrease in the availability of genes and alleles in providing microhabitat adaptation, disease and pest resistance, yield enhancement traits, etc., for future exploitation (e.g. to develop better or newly adapted varieties) which will restrict breeders options and have a necessary impact on future food security.

Why do CWRs need a National management plan for conservation?

CWR are unique resources for food security and are increasingly used for crop development and improvement⁵. However, they are becoming more threatened and are therefore suffering from genetic erosion. A coordinated, systematic and integrated *in situ* and *ex situ* approach to CWR conservation is essential to secure these critical resources. This is best practically implemented via national conservation plans because each nation is responsible for the conservation and sustainable use of the natural resources within its political boundaries and as such conservation is predominantly organised on a national basis. The national management plan for CWR conservation, as mentioned in Chapter 1, may be prepared using a floristic or monographic approach; the floristic approach uses as its basis the entire flora of the country and from this identifies the CWR present, while the monographic approach uses a list of the country's crop and that is matched against the flora to identify the CWR present. The national management plan for CWR conservation should combine at regional and eventually global level into a coordinated holistic approach to ensure that the most important CWR resources are conserved and available for use for crop improvement.

⁵ See Hajjar and Hodgkin (2007) and Maxted and Kell (2009) for reviews.

What are the general goals of a National management plan for conservation of CWRs?

A National management plan for conservation of CWRs aims at the long-term active conservation of the country's CWR taxonomic and genetic diversity, while at the same time promoting its use because experience has shown that through use comes conservation sustainability. Specifically with reference to *in situ* CWR conservation, once *in situ* CWR conservation sites (genetic reserves and informal *in situ* conservation sites) are established, they can be grouped into a coherent national network and provide an opportunity to monitor and assess short and long term changes in CWR diversity. This would help in addressing the CBD Strategic Plan⁶. Also, more specifically, the decision X/2 of the COP 10 (Nagoya, Japan, October 2010), to facilitate the assessment of progress towards the 2020 targets, "the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species" have been recognised as important elements of biodiversity to maintain "and [by 2020] strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity". A network of national CWR *in situ* CWR conservation sites would provide a unique opportunity to assess and meet this CBD 2020 target.

A.1.1. List of references used to compile the text

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⁶ CBD (2010b)

- September 2004, pp. 35–45. Published on behalf of the European Crop Wild Relative Diversity Assessment and Conservation Forum, by Bioversity International, Rome, Italy. 100 pp. Available from: <http://www.bioversityinternational.org/fileadmin/bioversity/publications/pdfs/1171.pdf> [Accessed May 2012].
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A.1.2. Additional materials and resources

General references on CWR:

-  Harlan J and de Wet J (1971) Towards a rational classification of cultivated plants. *Taxon* 20: 509-517.
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-  Maxted N, Dulloo ME, Ford-Lloyd BV, Frese L, Iriondo JM, Pinheiro de Carvalho MAA (eds) (2012) Agrobiodiversity conservation: securing the diversity of crop wild relatives and landraces. CAB International, Wallingford.
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W Crop Wild Relatives Global Portal: <http://www.cropwildrelatives.org/>
- WW Crop Wild Relatives Discussion Group: <http://tech.groups.yahoo.com/group/CropWildRelativesGroup/>
- WW
W Agricultural Biodiversity Weblog: <http://agro.biodiver.se/>



Diverseeds Documentary Film. Plant Genetic Resources for Food and Agriculture: <http://www.diverseeds.eu/index.php?page=video> (shows the importance of agricultural biodiversity for food and agriculture, with astonishing pictures from Europe and Asia)



Unlocking the secrets of Crop Wild Relatives:
<http://www.cropwildrelatives.org/cwr.html>