

ADAPTING AGRICULTURE TO CLIMATE CHANGE: COLLECTING, PROTECTING AND PREPARING CROP WILD RELATIVES

Background

Adapting agriculture to climate change is one of the most urgent challenges of our time. There is, quite simply, no more important step we can take to prepare for climate change than to ensure that the crops that feed humanity are adapted. The need for new crop varieties that can be productive in the new climates of the future is now widely recognized. It is much less well known that our ability to breed these new varieties cannot be taken for granted. The greatest source of untapped diversity, and in particular the richest source of diversity for *adaptive* characteristics needed to confront the challenges of climate change, are the wild relatives of our crops. Not only are these largely uncollected, and therefore unevaluated and unavailable to plant breeders and thus to farmers, many are also at risk of extinction. This project will help ensure that we win the race to collect crop wild relatives, protect them, and prepare them for use in plant breeding programmes in time to breed new crop varieties adapted to new climates.

Objective

A portfolio of plants, with the characteristics required for adapting the world's most important food crops to climate change, is collected, protected and prepared in a form that plant breeders can readily use to produce varieties adapted to future climatic conditions that farmers in the developing world will soon be encountering.

Description

The project is focused on the species related to 26 crops¹ of major importance to food security. It will:

- identify those crop wild relatives that are missing from existing collections, are most likely to contain diversity of value to adapting agriculture to climate change, and are most endangered;
- collect them from the wild;
- provide them to genebanks for conservation;
- prepare these and others already in collections ('pre-breeding') for use in breeding crops for new climates;
- evaluate them for useful traits; and
- make the resulting information widely available.

The pre-bred material incorporating the desired traits will be directly fed into ongoing, active and successful breeding initiatives aimed at helping poor farmers in developing countries increase food production, and made available to on-farm improvement efforts and farmers as appropriate. The project will run for ten years. It will introduce a range of new and exciting adaptive options for agriculture that might otherwise have been lost, whilst helping protect biodiversity from disappearing. The project will help build capacity in developing countries and will produce valuable information to assist in complementary on-farm and *in situ* efforts. Importantly, it will further implementation of the International Treaty on Plant Genetic Resources for Food and Agriculture.

Timeline

Activity	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Research										
Collecting										
Conservation										
Pre-breeding										
Evaluation										
Information										

Partnerships

The project will build bridges across intellectual spheres. It will draw in climate change experts, biodiversity conservationists, and agricultural scientists. The main partner is the Millennium Seed Bank of the Royal Botanic

¹The 26 crops and their wild relatives are covered by Annex 1 of the International Treaty. They are: alfalfa, apple, bambara groundnut, banana, barley, bean, carrot, chickpea, cowpea, eggplant, faba bean, finger millet, grasspea, lentil, oat, pea, pearl millet, pigeon pea, potato, rice, rye, sorghum, sunflower, sweet potato, vetch and wheat.

Gardens Kew, with its wide expertise in the *ex situ* conservation of wild species. Implementation will be carried out in close partnership with national PGRFA conservation and use programmes in developing countries and the CGIAR Centres. The Secretariat and national focal points of the International Treaty will be involved at all stages.

Beneficiaries

The ultimate beneficiaries of the project will be present and future generations of farmers worldwide, and the people that they feed. Farmers in developing countries will have access to the new and increased diversity in their crops they will need to cope with climate change. National agricultural research and conservation programmes will benefit from the enhanced conservation of the country's crop diversity as well as capacity-building, information and information systems, and partnerships the project will facilitate.

Summary of outcomes and outputs

Outcomes	Outputs
1. The collecting and use of novel genetic diversity for crop adaptation to climate change are informed by an assessment of the state of <i>ex situ</i> conservation of the wild species related to major crops (Crop Wild Relatives - CWR).	1.1 Database listing CWR taxa in the genebanks of at least 60 crops listed in FAOSTAT
	1.2 Database of ecogeographic information for CWR in at least 60 genebanks available for analysis
	1.3 Review of germination requirements of CWR in existing <i>ex situ</i> collections
	1.4 Identification of the gaps in the diversity available <i>ex situ</i> of CWR in at least 60 genebanks
	1.5 Strategy for the collecting of 26 priority Annex 1 crop genebanks available
	1.6 Guides for collecting in potential partner countries produced and made available
2. Novel and threatened diversity of CWR is collected, shared with breeding programs, and high quality seed safeguarded <i>ex situ</i> and accessible to researchers and other users worldwide.	2.1 Projects that engage and strengthen national capacity in CWR collecting in place with partner countries
	2.2 Target CWR taxa collected and seed samples sent to Kew for high quality processing
	2.3 Collected seed is processed, stored by partner national programs and duplicated at Millennium Seed Bank Kew and Svalbard Global Seed Vault, and shared with pre-breeding and breeding programs
3. Germplasm lines incorporating novel, useful diversity from CWR are available to breeders and farmers worldwide for enhancing crop adaptation to climate change.	3.1 Pre-breeding and evaluation strategies for selected priority crop genebanks developed with experts
	3.2 Case study on one or more crops produces germplasm lines incorporating diversity from CWR available <i>ex situ</i> and recommendations on strategy and methods to guide implementation of pre-breeding and evaluation on other crops
	3.3 Projects in place with national programs and research institutes to analyze the genetic diversity of CWR collections, identify target accessions for pre-breeding, and generate new germplasm lines through pre-breeding
	3.4 Projects in place with national programs and research institutes to evaluate breeding lines for traits of value to climate change adaptation and to make lines available to breeding programs and farmers
4. Researchers, collection holders, breeders and other users of plant genetic resources have access to information and information systems for improved conservation and use of CWR and other plant genetic resources.	4.1 Website giving the global community access to the information from the project's research and collecting activities, showing the impacts on the state of <i>ex situ</i> conservation of CWR and giving guidance to <i>in situ</i> conservation
	4.2 Capacity of national programs enhanced in the use of genebank data management system (GRIN-Global) for managing PGR collections
	4.3 Global portal to accession level information on plant genetic resources (Genesys) expanded to include data on the collected CWR and evaluated breeding products, plus additional PGR data from programs worldwide