ACP Science
and Technology II Programme

In situ conservation and use of crop wild relatives in three ACP countries of the SADC region

Wild relative of coffee (Coffea mauritiana) in full bloom in Black River Gorges National Park, Mauritius. © M.E. Dulloo

SUMMARY OF RESULTS

Over 50 scientific staff from 14 countries of the Southern African Development Community (SADC) were trained on *in situ* conservation methodologies, predictive characterisation and pre-breeding of crop wild relatives to better conserve and use these resources. A toolkit on conservation planning of crop wild relatives, templates and tools for preparing National Strategic Action Plans for the conservation and use of crop wild relatives as well as National Strategic Action Plans for Mauritius, South Africa and Zambia were developed. The diversity of crop wild relatives was documented and assessed, priority species for conservation and areas for *in situ* conservation were identified, and concrete and strategic actions for their conservation and use delineated. Together with farmers in Zambia, incentive mechanisms for their conservation were developed and conservation costs determined. A concept for a regional *in situ* crop wild relatives conservation strategy was developed for the SADC region.

GRANT
EUR 973,747.78

CONSORTIUM
- International Plant Genetic Resource Institute (IPGRI, operating under the name of Bioversity International), Italy
- University of Birmingham, United Kingdom
- University of Mauritius, Mauritius
- Department of Agriculture, Forestry and Fisheries, South Africa
- Ministry of Agriculture and Livestock, Zambia

PROJECT IMPLEMENTATION PERIOD
January 2014 - December 2016

PROJECT CONTACT
Dr. Ehsan Dulloo
Bioversity International
42 S. Sivananda Street
Rose-Hill 71368
Mauritius
Tel: +230-59360444
e.dulloo@cgiar.org
www.bioversityinternational.org

PROJECT WEBSITE
http://www.cropwildrelatives.org/sadc-cwr-project/

BACKGROUND

Climate change is having a severe impact on farming systems and farmers' livelihoods because of heavy dependence on local crop varieties which are not adapted to the changing environment. Climate change-induced loss of local landraces and crop wild relatives (CWR) is also fast occurring, leading to the loss of genetic diversity and traits useful for climate change adaptation. CWR species are often neglected due to ignorance of their value to agriculture by public policy, decision makers and wild habitat (including non-protected areas) managers. There is a lack of coordination between agriculture and environment sectors for an effective conservation and use of CWR. There is also little capacity among national-level scientists to effectively conserve and make use of CWR due to lack of tools to assess occurrences of CWR and to identify potential novel traits, new uses and market options.

The project was set up to enhance the scientific capacities in the SADC region to conserve CWR and identify potential traits for use to adapt to climate change, and develop National Strategic Action Plans (NSAPs) for conservation and use of CWR. The key problem addressed was the capacity of national programmes to be conserving CWR diversity *in situ* as a mitigation measure for adapting to climate change.

The research questions to be answered were:

- What capacities exist in the participating countries on the conservation and use of CWR?
- What tools do these countries have to effectively conserve and use their CWR?
- How many CWR exist in these countries and how are they distributed? What are their status in the wild? Which are priority CWR for the countries?
- What do policy makers and decision makers know about the importance of CWR and why should they be taking measures to conserve them and promote their use?

The stakeholders included: *Small-scale farmers* who face the effects of climate change and need access to new, adapted seeds and planting materials for sustainable, cost-effective agricultural production; *National agricultural and environment scientists*, including breeders, who are responsible for implementing (research) activities related to conservation and use of agricultural biodiversity; and *Public policy and decision makers* who develop policies relating to agricultural development and natural resource management and who are responsible for translating policies relating to food security and environmental protection into actions.

METHODOLOGY

Compile baseline information on CWR diversity
(checklist, prioritisation, ecogeographic survey)

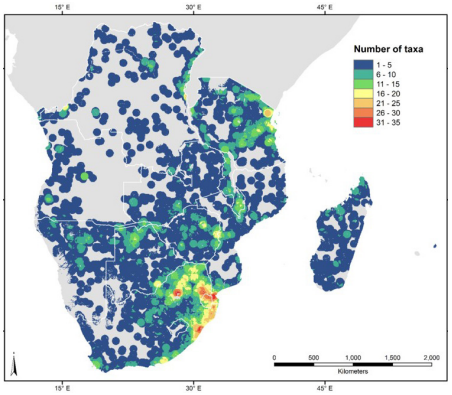
Identify CWR hotspots and priority sites for *in situ* conservation and *ex situ* collection (diversity analyses)

Predict which CWR *in situ* populations (*Sorghum and Vigna*) and materials from *ex situ* collections have traits adapted to drought tolerance (predictive characterisation)

Develop National Strategic Action Plans (NSAPs) for the conservation and sustainable use of priority CWR

Awareness raising at national policy and decision makers' level, general public level and throughout the international scientific community

Project staff engaging with local communities on in situ conservation incentives in Chiawa Camp, Lower Zambezi National Park, Zambia (April 2016). © Warwick Wainwright



CWR richness in the Southern African Development Community (SADC) region.

Field collecting of crop wild relatives in Burgesford, South Africa (March 2016). © Mahlatse Mogale

Baseline information on CWR diversity

The first step in conservation planning of CWR is to assess the diversity of CWR species present in each country (Mauritius, South Africa and Zambia) by making a checklist of all the CWR that exist in these countries. This is done by crossing the identified crop genera with the genera of the national flora checklist. Not all CWR can be conserved and thus CWR were prioritised according to a set of country specific criteria (e.g., potential of the wild relative in crop improvement, socio-economic value of the related crop, threat status). For each priority species the following was gathered: detailed taxonomic data, general distribution, genetic relationship to the crop(s), socio-economic value of the related crop, threat status and existing conservation actions. Using this a full inventory of CWRs was prepared.

CWR hotspots and priority sites for conservation

Occurrence data of the priority CWR was compiled and analysed using Geographic Information System (GIS) and spatial modelling tools. The tools were used to determine CWR distribution and specifically identify high concentration and complementary areas where active *in situ* conservation could be implemented.

Identification of traits from CWR

The identification of useful traits from drought-tolerant CWR of both *Vigna* (cowpea) and *Sorghum* was done in South Africa using predictive characterisation techniques. The CAPFITOGEN (Capacity building programme in support of national plant genetic resources programmes of FAO's International Treaty on Plant Genetic Resources for Food and Agriculture) tool was used to identify CWR populations with useful traits.

National Strategic Action Plans (NSAPs)

Once the CWR conservation planning was finalised, NSAPs were developed in collaboration with all stakeholders. Two national workshops were organised, the first to discuss the outline of the NSAP and the second to validate the final drafts.

Five tools were developed to guide and facilitate countries in national CWR conservation planning as well as in the development of their NSAP. The tools are as follows: 'Interactive toolkit for CWR conservation planning', 'Template for the preparation of a NSAP for the conservation and sustainable use of CWR', 'Template for the preparation of a technical background document for a NSAP for the conservation and sustainable use of CWR', 'CWR checklist and inventory data template', and 'Occurrence data collation template'. All these tools were made available on the project website and the 'SADC Crop Wild Relatives Project Dataverse' website, and are readily accessible for use in conservation planning of CWR and development of a NSAP.

Awareness raising

Awareness of the importance of CWR and their contributions to food security and the promotion of their *in situ* conservation was raised at policy and decision makers' level in the ministries of agriculture, environment and forestry. Each country organised national committees to bring together key stakeholders, including national policy makers, needed to ensure proper implementation of the project in their respective countries.

Awareness of the importance of CWR was also raised through TV broadcasts, posters, leaflets, and policy briefs. Presentations were given at major conferences of the FAO such as the Commission on Genetic Resources and the Governing body of the International Treaty on Plant Genetic Resources for Food and Agriculture. Project results were presented at the first Agrobiodiversity International Conference in New Delhi (India) in 2016.

RESULTS

Outputs

Stakeholders involved

- 307 scientists (101 female, 206 male).
- 14 breeders (2 female, 12 male).
- 191 decision/policy makers (59 female, 132 male).
- 98 farmers (35 female, 63 male).

Tools

- Interactive toolkit for CWR conservation planning.
- 4 templates on CWR collection and NSAP preparation.

Policy documents

- National Strategic Action Plans developed for Mauritius, South Africa and Zambia (of which those of South Africa and Zambia have been endorsed by their respective governments).

Capacity building

- 2 training workshops: *In situ* conservation of CWR and diversity assessment techniques; Predictive characterisation and pre-breeding.
- 41 national scientists (18 female, 23 male) from 14 SADC countries on conservation and use of CWR.

Visibility

- Project website.
- SADC CWR Dataverse website (https://dataverse.harvard.edu/dataverse/SADC_CWR_Project).
- 14 presentations, 2 papers and 3 posters at 19 national and international meetings and conferences.
- 4 TV broadcasts.
- 2 news articles.
- 1 video.
- 1 blog.

Publications

- Magos Brehm J. *et al.*, 2017. Interactive toolkit for crop wild relative conservation planning version 1.0. University of Birmingham, Birmingham, UK and Bioversity International, Rome, Italy. http://www.cropwildrelatives.org/conservation- toolkit/.
- Dulloo E. *et al.*, 2017. Template for the preparation of a National Strategic Action Plan for the conservation and sustainable use of crop wild relatives, doi:10.7910/DVN/QH9XWB, Harvard Dataverse, V1.
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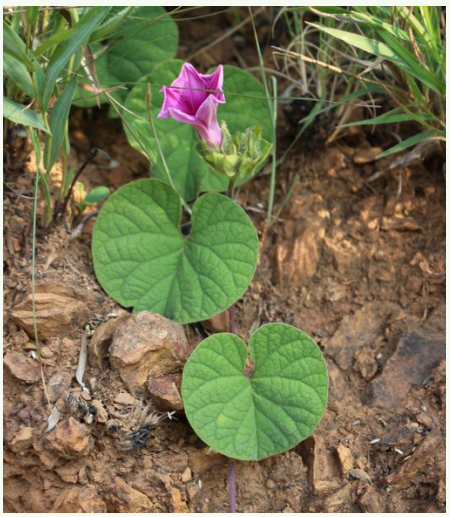
Oryza longistaminata, a crop wild relative of rice, Uningi Pans, Mbala district, Zambia.

Solanum lichtensteinii, a crop wild relative of eggplant, South Africa. © Livhuwani Auldren Nkuna



Ipomoea bathycolpos plants wild relative of sweet potato, Barberton, Mpumalanga province, South Africa. © Livhu - SANBI

- Magos Brehm J. *et al.*, 2017. Template for the preparation of a technical background document for a National Strategic Action Plan for the conservation and sustainable use of crop wild relatives, doi:10.7910/DVN/VQVDFA, Harvard Dataverse, V1.
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- Jansen van Rensburg W.S. *et al.*, 2017. Unlocking the potential of crop wild relatives using predictive characterization. Combined congress 2017, 23-26 January 2017, Klein-Kariba.
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- Ng'uni D. *et al.*, 2017. Technical background document to the National Strategic Action Plan for the conservation and sustainable use of cop wild relatives in Zambia, doi:10.7910/DVN/VYZZFF, Harvard Dataverse, V1.
- Rudebjer P. *et al.*, 2015. Capacity of SADC member states in *in situ* conservation and use of crop wild relatives in breeding programmes: Baseline report. http://www.cropwildrelatives.org/sadc-cwr-project/project-results/capacity-building/training-needs-assessment/.
- Gerrano A.S. *et al.*, 2014. Variability in cowpea germplasm assessed using phenotypic traits, International conference on Enhanced genepool utilization: capturing wild relative and landrace diversity for crop improvement, Cambridge, United Kingdom, 16-20 June 2014.
- Special issue on CWR in Journal Plant Genetic Resources Characterisation and Utilization (in press):
  - Allen E. *et al.*, 2018. A crop wild relative inventory for southern Africa: A first step in linking conservation and use of valuable wild populations for enhancing food security.
  - Bissessur P. *et al.*, 2018. Crop wild relative diversity and conservation planning in two isolated oceanic islands: The cases of Mauritius and Rodrigues.
  - Holness S. *et al.*, 2018. Spatial planning for the *in situ* conservation of priority crop wild relatives in South Africa. Plant Genetic Resources.
  - Magos Brehm J. *et al.*, 2018. New tools for crop wild relative conservation planning.
  - Ng'Uni D. *et al.*, 2018. Spatial analyses of occurrence data of CWR taxa as tools for selection of sites for conservation of priority CWR in Zambia.
  - Santchurn D. *et al.*, 2018. Contribution of sugarcane crop wild relatives in the creation of improved varieties in Mauritius.

RESULTS

Outcomes

- Improved knowledge of CWR diversity in the SADC region.
- Increased awareness about the value and importance of *in situ* conservation of CWR in scientific and political communities.
- Enriched capacity of scientists and breeders to apply new innovative tools (conservation planning, diversity analysis and CAPFITOGEN) allowing for identification of both hotspot areas for *in situ* conservation of CWR and desired traits found in CWR for breeding.

Impacts

Usage

- There is a lot of interest in the application of the various project resources. E.g., the CWR and NSAP templates are being downloaded from the *SADC CWR Dataverse website*. The online interactive toolkit for CWR conservation planning is useful for both the public and private sector.
- One of the training workshop attendees is doing a PhD in the UK on developing a CWR conservation strategy for Malawi with national stakeholder involvement.
- It is expected that in 5-10 years farmers will see the positive contributions that CWR can make to their crops, provided there are CWR of their crops in the vicinity and the environment is conducive to allow gene flow between the wild population and cultivated crops. Indicators of success would be the existence of better adapted crop varieties.
- The involvement of local communities in Zambia about the economic impacts of *in situ* CWR conservation resulted in perceiving how much Zambian farmer communities are willing to conserve CWR on-farm, specifically in field margins.

Policy implications

- *In situ* conservation of CWR is being considered in government policies in many SADC countries, e.g. endorsed National Strategic Action Plans (Mauritius, South Africa and Zambia), National Bioversity Strategy and Action Plan (Mauritius), Protected Areas Network Expansion Strategy (Mauritius and South Africa), National Agricultural Policy (Zambia), the National Plan for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture (PGRFA, South Africa), and South Africa strategy for implementing Target 9 of the Global Strategy for Plant Conservation.
- The SADC Plant Genetic Resources Centre (SPGRC) is using the results of the baseline survey to develop a regional strategy on CWR for the entire SADC region.
- The *in situ* conservation of CWR is a long-term process and will take years before CWR genetic reserves can be formally established. It would require interventions by policy makers and other national organisations to implement the recommendations established in the NSAPs.
- The templates for the preparation of NSAPs can be used as exemplars for development of NSAPs for other countries.
- The NSAPs should facilitate countries to mainstream the conservation and use of CWR in identified national policies.

Sustainability

- Project results can be sustained through the implementation of the NSAPs. Each NSAP contains an Action Plan with concrete activities, a proposed collaborative partnership, and clearly identified roles and responsibilities of the different stakeholders involved.
- The training materials can be used to scale up to other regions. Bioversity and the University of Birmingham plan to organise similar courses in different regions of Africa, Latin America and Asia to further develop capacities and create greater awareness of the importance of CWR.
- A network of stakeholders in the SADC region has been invited to join the International Union for Conservation of Nature (IUCN) Species Survival Commission's (SSC) CWR Specialist Group.

TESTIMONIALS

Chike Mba, Plant Production and Protection Division, FAO, Italy

"As Chairperson of the project Steering Committee I observed first-hand the impressive outputs of the multi-stakeholder endeavour. The project engendered a unique community of practice (COP) which developed and validated innovative tools. These tools enabled the mapping of CWR locations in resource-challenged countries that are home to these irreplaceable germplasm that are veritable repositories of novel traits for crop improvement. The trained scientists can now harness these traits for breeding resilient crop varieties to enhance crop production systems, as well as improving the nutritional qualities of staple crops. The COP also serves as a model to create a global network that could facilitate the conservation and sustainable use of CWR."

Dr. Julian Jaftha, Chief Director of Plant Production and Health, Department of Agriculture, Forestry and Fisheries (DAFF), South Africa

"As part of the project, South Africa hosted three consultative workshops, namely: the national stakeholder workshop, pre-breeding and predictive characterisation workshop and final dissemination workshop. DAFF, the South African Biodiversity Institute (SANBI) and the Agricultural Research Council developed a National Strategic Action Plan for conservation and sustainable use which was approved and endorsed by DAFF, key departments and relevant stakeholders. DAFF also incorporated CWR into their national plan for conservation and sustainable use of plant genetic resources for food and agriculture. The project assisted DAFF and its stakeholders to bring a national focus to the conservation of CWR."

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