



## 2017 Review of the SPC Centre for Pacific Crops and Trees (CePaCT) Long Term Collections

<b>Program:</b> Science & Programs	
<b>Genebank reviewed:</b> CePaCT	<b>Site visit dates:</b> 31 Jul – 4 Aug 2017
	<b>Review report date:</b> 9 Oct 2017
	<b>CePaCT and Crop Trust responses:</b> 01 Dec 2017
<b>Place:</b> Suva, Fiji and Apia, Samoa	
<b>Genebank Curator</b>	Ms. Logotonu M. Waqainabete
<b>Review Panel</b>	Ehsan Dullo
	Steve Adkins
<b>Crop Trust staff</b>	Paula Bramel

Review of CePaCT's Long Term Collections

	<b>Recommendation</b>	<b>Responses by CePaCT</b>	<b>Responses by Crop Trust</b>
1.	<p>The review team recommends that LRD management add an additional thematic area under the Genetic Resources Pillar and the second thematic area reworded to prioritize to the multiplication and distribution function, so that the set of thematic areas under Genetic Resources Pillar would read as follows:</p> <ul style="list-style-type: none"> <li>• A long term conservation facility for the Pacific region (CePaCT)</li> <li>• Multiplication and distribution</li> <li>• Genetic diversity: Crops/Trees/livestock</li> <li>• Developing, evaluating, and trialling climate smart varieties</li> <li>• Breeding and seed systems</li> <li>• Community based seed systems</li> </ul>	<p>We appreciate the concern of the review team with regard to the thematic areas under the Genetic Resources Pillar. However, we believe that there is no need to separate the conservation mandate from the distribution mandate of the CePaCT genebank. It is an obligation of any genebank to conserve, multiply/propagate and distribute germplasm. If a genebank only conserves germplasm, it is considered a 'museum' that is not really contributing to food and nutrition security.</p> <p>After internal deliberations, we are considering the following thematic areas under the Genetic Resources Pillar:</p> <ul style="list-style-type: none"> <li>• A genebank facility operating at international standards and acquiring, conserving and distributing genetic diversity of crops, trees and, with a long-term perspective, small livestock for the Pacific region (CePaCT)</li> <li>• Screening, development, evaluation, and distribution of climate-resilient and highly nutritious varieties</li> <li>• Strengthening participatory breeding and seed systems in the Pacific region</li> <li>• Establishment and strengthening of community based seed banks</li> </ul>	<p>The Crop Trust appreciates the carefully considered changes in the thematic areas under the Genetic Resources Pillar. We agree with the changes proposed by CePaCT.</p>
2.	<p>The review team recommends that a barcoding system be used that can better manage and track the routine operations applied to the accessions for their conservation (see also Recommendation 5 concerning an accession level documentation system).</p>	<p>This recommendation is well taken and CePaCT management is convinced that a barcoding system is necessary to improve tracking of the standard operations applied to the accessions in their routine maintenance and conservation in the genebank and to link this information with the documentation system. Inquiries will be made to identify barcode printer and scanner models that are suitable for the CePaCT operations with a software that allows easy data capture and integration into CePaCT's documentation system.</p>	<p>The Crop Trust is very pleased with CePaCT's commitment to a barcoding system.</p>
3.	<p>The review team recommends that all arriving germplasm should first go into a quarantine holding area, possibly the old tennis court alongside the CePaCT laboratory, until viral indexing can take place. Once certified virus-free,</p>	<p>The CePaCT genebank will aim to hold all arriving germplasm in a post-entry quarantine facility until virus indexing is completed by the CePaCT virology laboratory. Once certified virus-free, materials will be introduced into aseptic culture and stored as part of the active and long-term in vitro collections. If viruses or other diseases or insect pests of quarantine concern are detected, disease/pest elimination attempts will proceed until</p>	<p>The Crop Trust agrees with the actions being proposed by CePaCT.</p>

Review of CePaCT's Long Term Collections

	<p>materials can then be introduced into aseptic culture and placed into the collection.</p>	<p>the material is found clean. CePaCT management is currently seeking approval from senior SPC management to use the old tennis court for that purpose. Should approval not be granted, alternative sites will need to be explored.</p>	
<p>4.</p>	<p>The review team recommends that re-culturing of both active and conservation collections should not go beyond 10 subcultures before new cultures are re-established from newly sourced material from the field or the quarantine collection</p>	<p>The recommendation that re-culturing of both active and conservation collections should not go beyond 10 subcultures, means that every five years, all crops with a total of over 2100 accessions would need to be re-established from newly sourced material from the field (in partner countries where the material was originally collected and in some cases might no longer be found) or the quarantine collection which is non-existent for the current genebank holdings. Such a drastic procedural change would mean a tremendous cost increase of the CePaCT operations and might render it unsustainable.</p> <p>There are many factors influencing the occurrence of somaclonal variation, such as time in culture, number of sub-cultures, composition of the growth medium, especially the presence of growth regulators and their concentration, and last but not least the genotype of the material cultured in vitro. At CePaCT, growth regulators are only added to the medium at the initial establishment and multiplication stage. During the maintenance phase only standard MS medium is used, which would have minimal effect on somaclonal variation, if any.</p> <p>We should also be aware that other international genebanks are keeping their material for at least 20 years in vitro before starting the rejuvenation process. Hence, a recommendation for the CePaCT genebank to go into a rejuvenation process every five years (after 10 subcultures) seems to be too ambitious, especially given the absence of growth regulators during the maintenance phase of both the active and long-term conservation collection.</p> <p>To address the recommendation of rejuvenating the entire collection after 10 subcultures we could try to carry out trials for all major crops of the CePaCT genebank to extend the current subculture period from six</p>	<p>The Crop Trust agrees with the response that more research on somaclonal variation is needed, the establishment of extended sub-culture period for all the crops, and the development of DNA level monitoring systems for somaclonal variation is an efficient step towards reducing the risk of somaclonal variation and ensuring the genetic integrity of the accessions.</p>

Review of CePaCT's Long Term Collections

		<p>months up to possibly one year or even longer. If successful that would mean that rejuvenation could be attempted every ten or 15 years instead of every five years.</p> <p>Furthermore, once the new fingerprinting facility has been established at CePaCT (planned for 2018), the CePaCT molecular biology team could undertake research to detect potential somaclonal variation in the in vitro material, dependent on the number of subcultures, composition of the medium, crop, genotype, etc. to come up with research-based recommendations on the number of subcultures which are safe to exclude risks of somaclonal variation and to guarantee the trueness-to-type of cultures produced by the CePaCT team.</p>	
<p>5.</p>	<p>The review team recommends that a documentation and database consultant position be recruited to strengthen the implementation of the barcoding system, advise on the development of the documentation system and ensure a smooth transition towards its application in the genebank. The review team believes that such a position will be critical to allow CePaCT to achieve an international standard in genebank documentation and information management. (See also recommendation 12).</p>	<p>The Crop Trust review team based their recommendation on Michael Mackay's "Report on status of information management at CePaCT", dated 24 to 26 March 2015. Unfortunately, Albert Fiu, who joined CePaCT as database manager in December 2015, was not yet around when Dr. Mackay prepared his report. Albert underwent a 2-week documentation training led by Michael Mackay at CePaCT in early 2016 and started implementing many of the recommendations made by the documentation consultant as follows:</p> <ol style="list-style-type: none"> <li>1. Passport data standards Accession-level data of the CePaCT collection have been standardised following criteria of ISO country codes, WIEWS institute codes, Multi-Crop Passport Descriptors and GRIN Global Taxonomy (provided by Michael Mackay), and implemented within CePaCT operations.</li> <li>2. Importation and distribution data management activities to be in line with the workflow The key CePaCT genebank procedures have been mapped and data standardised so that data management is now fully aligned with the genebank workflow.</li> <li>3. Address characterisation and evaluation data</li> </ol>	<p>These updates are well appreciated and acknowledged. The Crop Trust supports CePaCT's plans on data management and strengthening the quality management system.</p>

		<p>This task is still in progress.</p> <p>4. Develop an operational manual of standard operations          After the recent mapping of the key procedures of the CePaCT genebank, led by the SPC Genetic Resources Expert (Andreas Ebert), staff of the genebank were tasked—based on their current responsibilities—to develop and maintain/update standard operational procedures (SOPs) for (1) Collecting, (2) Acquisition, (3) Conservation, (4) Distribution, (5) Plant Health, (6) Database Management, (7) Rejuvenation/characterization, (8) Safety duplication, and (9) Administration. The SOPs developed through this approach will be compiled into a comprehensive Operational Manual. The document illustrating the key CePaCT genebank procedures elaborated by the CePaCT team has been shared with and endorsed by Dr. Janny van Beem, QMS Manager of the Crop Trust. As individual SOPs become available, they will also be shared with Janny, for further guidance.</p> <p>5. Involve the personnel inputting and maintaining data in design of the use interfaces          In an attempt to streamline data flow as well as maintain data integrity, a procedure for data capture and upload has been designed, based on suggestions provided by the CePaCT team members. The ultimate goal is to also integrate virus indexing so that the database becomes a fully-fledged CePaCT genebank documentation and information system (PACGEN) serving the needs of internal and external users. The Pacific Information System (PAIS) and the PAPGREN website could provide a link to access passport and/or characterization/evaluation data in the PACGEN database.</p> <p>Rather than hiring another database consultant, we believe that a further training of Albert with regard to the implementation of a barcoding system at CePaCT and its effective integration into the current database, still under development, would be the best solution to achieve a comprehensive and effective CePaCT genebank documentation and information system that operates at international standards. Albert will</p>	
--	--	--	--

Review of CePaCT's Long Term Collections

		need an Assistant to compile, verify and capture raw data, not yet uploaded into the database.	
6.	The review team is in full agreement with Mackay's third recommendation, in that CePaCT should adopt a number of easily deployable standards for their passport data, including FAO/Bioversity Multi-crop Passport Descriptors, the three-character ISO 3166-1 country codes, FAO WIEWS Institute codes and USDA GRIN Taxonomy.	<p>As stated in our reply to recommendation 5, the CePaCT database manager, Mr. Albert Fiu is deploying international standards for the CePaCT passport data as recommended by Dr. Mackay, including FAO/Bioversity Multi-crop Passport Descriptors, the 3-character ISO 3166-1 country codes, FAO WIEWS Institute codes and USDA GRIN Taxonomy. This can be easily checked on the Genesys portal, to which Albert uploaded/updated in November 2016 the complete passport data of the CePaCT collections with 2163 accessions, achieving an average PDCI score of 3.93, with a minimum score of 3.45 and a maximum score of 4.20. This PDCI score represents a good average among international genebanks.</p> <p>While the CePaCT audit report of 6th October 2017 states that less than 10% of passport data of the taro collection are available online (Figure 1), the Genesys portal indicates that passport data of the taro collection are 100% available online, and the same applies to all other CePaCT collections.</p>	The Crop Trust is pleased to be informed of this progress since 2016.
7.	The review team recommends that no distribution be made until due diligence is made of the capacity of recipients to adequately receive, establish and evaluate the materials.	<p>Looking at CePaCT's annual germplasm distribution during the years 2010, 2012, 2014, and 2015, the total number of accessions distributed by year to 22 PICTs was, on average, below 390 accessions or 17 to 18 accessions per country per year. This seems to be a reasonable if not a low number of accessions distributed by CePaCT on a yearly basis to the Pacific region. Moreover, the average number of plants per accession distributed from 2009 to 2015 was 9.1, a very reasonable number, considering that a few plantlets might always die in transit or during the establishment attempts by the recipient institutions.</p> <p>CePaCT staff are fully aware that special care and expertise is required to handle and establish tissue-cultured plantlets successfully. For that reason, institutions from the Pacific region requesting CePaCT germplasm have been encouraged to undergo a hands-on training on the</p>	The Crop Trust appreciates this detailed response and agrees that CePaCT cannot decline legitimate requests. The sentiment of the recommendation is to request that CePaCT staff carefully consider if there is any reason to doubt that recipients of germplasm will be able to care appropriately for the plantlets sent from CePaCT. It is key that staff are communicating on this issue with requesters

Review of CePaCT's Long Term Collections

		<p>handling of tissue-cultured materials at the CePaCT facilities. To date, staff from most PICTs have undergone training at CePaCT in the handling of tissue-cultured material, either on an individual basis or attending a scheduled group training. CePaCT continues to offer similar types of training to strengthen human capacity in biotechnology in the Pacific region.</p> <p>Although numerous capacity building measures have been conducted by the CePaCT team to train staff from most PICTs in the safe and successful handling of tissue-cultured material, we acknowledge that the current capacity in PICTs still is and will remain a limiting factor, given the scarce amount of resources available to be devoted to this kind of work. However, this should not stop distribution of germplasm—it has not stopped distribution in other regions of the world that suffer a similar lack of capacity (e.g. West, Central, and East Africa). CePaCT will continue to seek ways of improving technology (e.g. through our bioreactor work) and to build national capacity. CePaCT will strive to distribute as strategically as possible, but cannot decline legitimate germplasm requests from PICTs. A moratorium on germplasm distribution would cause a political uproar with severe consequences for SPC. Germplasm donor countries might no longer entrust germplasm to SPC-CePaCT for long-term conservation if the donated germplasm is not shared when legitimate requests are made.</p>	<p>and recipients before they send the materials, including coordinating the date and time that the plantlets should be received and following that they are received in good condition. The Crop Trust recognizes that CePaCT has worked to build capacity in this area and supports their continued efforts.</p>
8.	<p>The review team further recommends that CePaCT prepare a written agreement for recipients of germplasm for evaluation to sign before any request is approved. The agreement should request the recipient to send a report to CePaCT on the condition of material received and a report on the characterisation and evaluation results, as they become available so as to increase the value of the collection.</p>	<p>CePaCT is distributing germplasm based on the 2014 FAO Genebank Standards using the Standard Material Transfer Agreement (SMTA) and following international and national rules and regulations regarding the safe movement of germplasm. The SMTA clearly defines the rights and obligations of both the recipient and the provider of germplasm in providing data under the multilateral system. Once material has been sent to the recipient, CePaCT follows up via email with a survey on the quality and conditions of the material received, and at a later stage on the performance of the materials, which is as much as any international collection might be expected to do. The recipient may use or conserve the material for research, breeding or training as stated in the SMTA. On the</p>	<p>The Crop Trust supports CePaCT's response. A commitment to follow-up with users is key to addressing this recommendation.</p>

Review of CePaCT's Long Term Collections

		<p>germplasm order form (GOF) to be filled in by any user of CePaCT germplasm, the potential user has to indicate how the materials will be used before germplasm is being released.</p> <p>In addition to the information to be provided in the GOF and the signing of the SMTA, SPC-CePaCT also requires the signing of a Material Transfer Agreement Letter (MTAL) before germplasm is being released to the recipient. The MTAL stipulates under clause 17: “The Recipient also agrees to provide the SPC CePaCT with the results from research carried out on the germplasm in any publications reporting on its use. The Research Evaluation Forms (electronic copies) from CePaCT are attached or will be sent together with the Plant Condition Form (PCF) to be filled on receipt of the germplasm. These forms are very valuable sources of information for the Centre which would help improve our services as well as updating the main Pacific Genetic Resources Database system regarding responses received on germplasm evaluated under different environmental conditions.” In our view, the MTAL, which has to be signed by any recipient before germplasm is being released, is exactly addressing the issues raised under Recommendation 8. There is no need to engage in additional agreements or MoUs between provider and recipient. CePaCT will encourage recipients to share performance and evaluation data of the germplasm received if the recipient is in a position to undertake an evaluation of the material but cannot enforce such an obligation with a legal instrument. In addition to the PCF and germplasm evaluation forms to be returned by the recipient, SPC-CePaCT may follow-up in individual cases on the use and the effectiveness of the use of CePaCT germplasm through field visits.</p>	
9.	Further, CePaCT should develop a simpler evaluation data form to help recipients to provide feedback on the evaluation data. As is possible, digital means for capturing information (including photographic images) should be promoted.	The need to standardize crop descriptor lists and germplasm evaluation protocols was highlighted during the recent Pacific Plant Genetic Resources Network (PAPGREN) meeting held in Nadi, Fiji (September 2017). CePaCT is taking the lead in compiling—in collaboration with other countries, like Papua New Guinea—minimum descriptor lists for each of the major crops in the Pacific. Similarly, crop evaluation protocols for screening of germplasm for abiotic and biotic stresses will be compiled	The Crop Trust agrees with the response. This is an excellent initiative.

Review of CePaCT's Long Term Collections

		<p>and standardized. Once compilation and standardization is completed, these protocols will be published on the PAPGREN and CePaCT websites for wide dissemination within and adoption by the PICTs. This will allow the capturing of information on the performance of CePaCT germplasm for the benefit of future users and will guide SPC researchers and breeders in the development of new varieties.</p> <p>In case project funds are available for the evaluation of germplasm shared by CePaCT, then more comprehensive studies can be performed, looking at different conditions (field, greenhouse, laboratory) and criteria (methodology). Evaluation could be aimed at abiotic or biotic stress tolerance screening, tasting of fresh or processed plant material, participatory breeding, etc. Evaluation forms would need to be developed and agreed upon between all project partners based on the project objectives and proposed methodology.</p>	
10.	<p>The review team recommends that CePaCT hire a consultant on risk management, with international experience on tissue culture labs to advise and oversee the preparation of a risk management plan and contingency plan. The Crop Trust should be able to advise CePaCT on the consultant.</p>	<p>According to the external review report, risk management of the CePaCT facility itself is well taken care of by the OH&amp;S committee of SPC-LRD. There are regular drills, and the equipment, and generators etc. are all well serviced institutionally. The CePaCT genebank management has established a good monitoring alarm system for its high temperature cut off. Staff are organised on a roster for checking AC units and equipment.</p> <p>A contingency plan to address possible threats to the cultures by natural disasters, such as cyclones, has been set up and will be implemented in the near future (see recommendation 11). A subset (three cultures each) of all TC accessions will be set aside within the long-term conservation room for easy identification and evacuation into a specially secured shipping container, equipped with power supply and connected to a standby generator, in case the path of a cyclone of category 1 or above, has been predicted to hit the CePaCT facilities.</p> <p>As a longer term measure, there is an urgent need to secure at least a core collection of the major crops in cryopreservation at CePaCT, as well as outside of Fiji Islands, either in the Pacific region or in Europe.</p>	<p>The Crop Trust agrees with this response. We also encourage CePaCT to integrate risk management in the development of its QMS if it is not already doing so.</p>

Review of CePaCT's Long Term Collections

11.	Further it recommends that a shipping container with power generation be acquired and placed alongside the CePaCT genebank to serve as a refuge for cultures in the event of future natural disasters such as cyclones (see also Recommendation 20 - post-cyclone Winston).	Appropriate safety duplication should deal with this recommendation. As a temporary measure, the CePaCT management will consider working with SPC-LRD to purchase a shipping container with power supply, connected to a standby generator, to serve as refuge to the CePaCT cultures in the event that the building structure is likely to be damaged by cyclones or other natural disasters.	The Crop Trust agrees with this response.
12.	The review team recommends that given the core responsibilities of the genebank, the SPC should recruit the following permanent positions: <ul style="list-style-type: none"> <li>• A CePaCT genebank coordinator (international position)</li> <li>• A curator</li> <li>• A documentation and data officer</li> </ul>	SPC-LRD welcomes this recommendation and is currently seeking corresponding budget allocation from senior SPC management to be able to start the recruiting process of the CePaCT Genebank Manager, an international position. A very capable curator is already in place as well as a database and information management officer, although this position needs to be made into a core staff position. The latter needs a documentation assistant to compile, verify and capture raw data, not yet uploaded into the database. Furthermore, a seed/planting material multiplication and distribution officer is needed to handle germplasm requests. The virus diagnostics and molecular biology lab also requires a well-trained permanent staff (expected to return early 2018 from his PhD studies in Australia) with two capable laboratory technicians to run the routine activities of both laboratories.	The Crop Trust agrees that the strengthening of the core team at CePaCT as proposed is very important to it fulfilling its mission.
13.	The review team recommends that a twinning arrangement with an internationally reputable institution be established to allow such exchanges to take place.	This recommendation is well taken. Discussions are underway with a few internationally reputable institutions to identify one that is willing to engage with SPC-CePaCT in a twinning arrangement for capacity building and exchange of latest protocols in clonal conservation and propagation as well as cryopreservation.	The Crop Trust very much supports the steps given in the response.
14.	The review team recommends CePaCT explore how it might offer a number of valuable services potentially as a source of income, but not at the expense of the core conservation and use functions and should only be	CePaCT is already a key player in capacity-building of human resources in the Pacific region and is regularly offering short-term training courses and individual hands-on training in the field of biotechnology to technical staff. Training in virus indexing and disease elimination as well as molecular characterization of crops is another area, which might be offered by CePaCT starting in 2018 when the virus diagnostics and	The Crop Trust agrees with this response and welcomes future plans for capacity building.

Review of CePaCT's Long Term Collections

	<p>carried out on a full cost recovery basis.</p>	<p>molecular marker officer returns from his PhD studies. With the intended strengthening of the PAPGREN genetic resources network in the Pacific region, the importance of CePaCT as a hub for capacity building in the region will grow. We aim at full-cost recovery when we offer such capacity building as was the case, for example, with the recent training on coconut embryo culture offered by the University of Queensland, Brisbane, Australia, at the CePaCT facilities at the end of October 2017.</p> <p>Private sector entities might be willing to pay for virus-indexing or fingerprinting services and this would be a welcome if rare source of income for CePaCT. New hybrid varieties developed by SPC breeders could be made available to seed companies on an exclusive basis during the first 2-5 years at an access fee that would allow to recover some of the investments made for crop breeding.</p>	
15.	<p>The review team recommends that within SPC LRD, the Pacific Tree Seed Centre be integrated and CePaCT genebank and facilities including staff and equipment between the two conservation facilities be shared to mutual benefit under one management.</p>	<p>Discussions have started within SPC-LRD to merge the Pacific Tree Seed Centre with the CePaCT genebank for mutual benefit, efficient use of equipment, stronger interaction, and joint proposal development and implementation.</p>	<p>The Crop Trust supports CePaCT's actions.</p>
16.	<p>The review team recommends that the CePaCT coordinator position with international experience be filled as a long-term appointment as soon as possible. Besides heading the genebank and being responsible for the overall management of the genebank, the coordinator should also have the responsibility in developing global partnerships with other centres and network and contribute to the</p>	<p>SPC-LRD welcomes this recommendation and is currently seeking corresponding budget allocation from senior SPC management to be able to start the recruiting process of the international CePaCT Genebank Manager position (see reply to Recommendation 12). The recently hired Genetic Resources Expert has already undertaken preparatory measures to introduce a Quality Management System at CePaCT to improve genebank operations. He has also initiated first steps towards establishing global partnerships with the International Musa Transit Centre in Belgium and others. He is supporting the CePaCT team with regard to contributions to the global objectives of the International Treaty and FAO's Global Plan of Action. The CePaCT Curator, Ms. Logotonu Meleisea</p>	<p>The Crop Trust agrees with this response.</p>

Review of CePaCT's Long Term Collections

	<p>global objectives of the International Treaty and FAO's global plan of action. (See also Recommendation 12- staff)</p>	<p>Waqainabete, attended the Seventh Governing Body meeting in Rwanda early November 2017, upon invitation by FAO and in representation of SPC and the Pacific region</p>	
<p>17.</p>	<p>It is recommended that CePaCT genebank supports SPC member countries in achieving the implementation of the Second Global Plan of Action for the Conservation and Use of PGRFA, as part of the global system, specifically for the priority activities for ex situ conservation, in serving as safety backups for the national collections, in building capacity and in promoting use of PGRFA of importance in the region.</p>	<p>CePaCT is working with FAO and the regional Plant Genetic Resources Network PAPGREN to build capacity and support PICTs in the implementation of the Second Plan of Action for the conservation and use of PGRFA. Several recommendations were made to this effect during the recent PAPGREN meeting held in Nadi, Fiji at the end of August 2017.</p> <ul style="list-style-type: none"> <li>• There is a need for PAPGREN to become more formalized and institutionalized with a defined role and scope, e.g., a forum for sharing information and knowledge on technical and scientific matters, such as PGR conservation, characterization, evaluation, propagation, and breeding. CePaCT will support PAPGREN to achieve this new role.</li> <li>• Apart from scientific, and technical advisory services, PAPGREN should also come up with policy recommendations in the area of conservation and sustainable use of PGRFA, including underutilized species and crop wild relatives</li> <li>• There is a clear role for CePaCT and PAPGREN to focus on the conservation and sustainable use of agricultural biodiversity as a way to contribute to diverse diets and the development and dissemination of highly nutritious crop varieties, including traditional, underutilised crops</li> <li>• Home and school gardening programmes help preserve traditional varieties and crops of high nutritional value and contribute to healthy diets in the PICTs and should, therefore, be strengthened.</li> <li>• Processes and protocols in PGRFA work (in situ/on-farm and ex situ conservation, characterization, evaluation, and pre-breeding) should be standardized and harmonized within the region so that results obtained can be easily compared and validated.</li> <li>• PAPGREN members with more fundamental research capacity and experience could assist CePaCT in the screening of material for abiotic and biotic stresses at the laboratory/field level, based on agreed protocols and screening methods.</li> <li>• SPC-CePaCT should make laboratory space available and adopt existing protocols for coconut embryo culture and cryopreservation to</li> </ul>	<p>The Crop Trust is pleased to see the initiatives from PAPGREN that relate to this recommendation. We hope that the Business Plan developed by CePaCT might be able to explore such opportunities.</p>

Review of CePaCT's Long Term Collections

		eventually receive a duplicate of the international coconut collection based in PNG. As per recommendations of the recent Steering Committee meeting of COGENT held in Nadi, Fiji, the Asian and Pacific Coconut Community (APCC), an intergovernmental organisation of states in Asia-Pacific, will host the COGENT Secretariat. APCC and SPC will develop a joint LoA on responsibilities and roles of each institution within the context of the new hosting arrangement for the COGENT Secretariat aiming at efficient conservation and safe movement of coconut germplasm within the Pacific region and beyond.	
18.	The review team recommends that humidity within the growth room be monitored and to check to see if the air conditioning is functioning properly and effectively reducing humidity in the room, before purchasing dehumidifiers.	The air conditioning system in the growth rooms is functioning properly and is being checked at regular intervals. If and when funds become available, we plan to purchase and install thermohygrographs in the growth rooms to measure and register temperature and relative humidity on a continuous basis over a long period of time. However, water condensation on the inside of the walls of the growth rooms continues to occur, especially during the hot and humid summer months. In order to ensure the security of the tissue cultures, we have to contain humidity in the culture rooms and will, therefore, opt to purchase dehumidifiers.	The Crop Trust agrees with this response but increased capacity for monitoring temperature and relative humidity in the growth rooms also needs to be seen as a priority, even if you have the dehumidifiers.
19.	It is recommended that CePaCT should carefully evaluate the need for acquiring new accessions of other priority crops consistent to their mandate in relation to threats from cyclones and climate change. However, high priority should still be given to aroids, yams and breadfruit.	As per recommendation 17, CePaCT will assist PICTs in safeguarding valuable PGRFA of the region, threatened by climate change. However, the Centre will ensure that duplication of similar genetic diversity, already conserved by CePaCT, is avoided. As per CePaCT mandate, top priority will be given to aroids, yams, banana, sweet potato, breadfruit, and coconut.	The Crop Trust agrees with this response.
20.	The review team fully endorses this idea and strongly recommends that, given the long term mandate of the genebank, a new large container (rather than an old container) with power generation be acquired and	As per SPC response to recommendation 11, this recommendation is well received and CePaCT management will work with SPC-LRD to purchase such a shipping container with power supply, connected to a standby generator, to serve as refuge to the CePaCT cultures in the event that the building structure is prone to damage by cyclones or other natural disasters. CePaCT management is currently seeking approval from	The Crop Trust agrees with this response.

Review of CePaCT's Long Term Collections

	<p>strategically located next to the genebank building in the space occupied by the unused "tennis court". This location is ideal for the quick evacuation of the cultures. This recommendation also addresses the mitigation of risks of natural disasters that are likely to damage the genebank collection. The review team also recommends that this space can be used during safe periods for other genebank activities. (See also Recommendation 3 and 11)</p>	<p>senior SPC management to use the old tennis court for that purpose. Should approval not be granted, alternative sites will need to be explored.</p>	
21.	<p>The review team recommends wire guides or props are installed to support the weak trees and firmly attached in concrete at four opposite sides of each tree. This will allow water to seep through the soil more easily and not to have a permanent concrete cover over the ground.</p>	<p>This recommendation is well received. Wire guides firmly attached to concrete blocks in the soil will provide good support to weak, inclined trees in the collection.</p>	<p>The Crop Trust is pleased to see that CePaCT is responding to this recommendation.</p>
22.	<p>The review team further recommends that duplicates of each of the breadfruit accessions be propagated and kept in pots in field genebank to be established, as a precautionary measure, in case accessions are lost.</p>	<p>This recommendation is well taken. To secure the breadfruit collection, the accessions need to be duplicated. However, due to space problems in the field, we propose to introduce each accession into the active and long-term in vitro collection. Thus, we would have two modes of conservation (field and in vitro) for the breadfruit collection.</p>	<p>The Crop Trust agrees with the response. This is an excellent initiative to secure these collections.</p>



# **Review of the SPC Centre for Pacific Crops and Trees (CePaCT) Long Term Collections**

**July 31 – August 4, 2017**

**Drs Ehsan Dulloo and Stephen Adkins, Consultants**

Executive Summary with Key Recommendations .....	16
Purpose of the Review.....	17
Methodology of the Review.....	18
Strategic Positioning of the CePaCT Genebank within SPC .....	19
Review of the Operational Procedures of the CePaCT Genebank .....	19
Workflow in the CePaCT genebank:.....	21
Documentation .....	24
Impact of the Distribution of Planting Materials from the CePaCT Genebank.....	25
Risk management: .....	26
Staff – training: .....	26
Assess the Roles and Services and use of CePaCT Genebank and the Linkages with Users and Partners .....	27
Status of CePaCT collections in the context of global system of conservation and use of the Pacific crops (and trees) .....	28
Reporting to the International Treaty on PGRFA: .....	28
Facilitating role to reporting on the Second GPA: .....	29
Review of the strengthening of crop conservation post cyclone Winston.....	30
References .....	31
Acknowledgements.....	31
Abbreviations .....	32
Annexes.....	32
The Terms of Reference (TOR) for the Genebank Review Panel.....	32
The Background Documents Provided to the Reviewers.....	34
The Programme of the Site Visits in Suva and Apia .....	35
The Capacity to undertake Cryopreservation at SPC CePaCT .....	38

## Executive Summary with Key Recommendations

The review of the SPC's Centre for Pacific Crop and Trees (CePaCT) was carried out from 31 July to 4<sup>th</sup> August 2017 in Suva, Fiji and Apia, Samoa. This reports covers the main findings from the visit made to the CePaCT genebank facility, staff interviews, and field visit to some partners of the CePaCT.

The review team was impressed with the dedication of the genebank staff in carrying out their work, their organisation in managing the genebank, their team spirit and support they have for each other, despite the changes in management at both the genebank and Land Resources Division (LRD) levels. The review team recognised that the genebank is operating at a difficult time when it is experiencing a decline in the number of staff (having lost seven staff since 2016) and with some decline in operational funding. There is also a great demand to provide virus-free planting materials from the genebank for distribution to clients. These factors have led to backlogs occurring for some of the core activities of the genebank.

As the review team task was to assess and analyse where the CePaCT's programme may be improved, this has resulted in the identification of some perceived weaknesses, as well as a limited number of recommendations to correct for such weaknesses. It goes without saying that this should not be construed as a highly critical assessment of the staff work. They are all very capable workers. However the review team believes that the programme is faced with a number of internal and external factors that are largely undermining their performance, which is at the low end of the accepted standards for most recognised genebank performance indicators.

It is the understanding of the review team that the value of the CePaCT genebank is globally recognised as holding one of the most diverse collections of edible aroids in the world, and as an important contributor to food security for the people of the Pacific and beyond. We recognise that by signing the agreement with the Governing body of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), SPC has committed to placing its collections within the multi-lateral system under Article 15 of the Treaty, thereby contributing to a rational, co-ordinated, forward-looking global system for the conservation and use of Plant Genetic Resources for Food and Agriculture (PGRFA) that is vital to ensure global food security. It also committed itself to ensuring to upgrade its genebank facilities and operations, and to provide sustainable funding to maintain its standards to international norms so as to continue to be eligible for long term funding support (in perpetuity) from the Global Crop Diversity Trust (Crop Trust).

The review team appreciates that the institutional change and the organisation of the work of LRD into four pillars is a necessary shift in the organisation structure, strategy, and objectives to respond to current regional and global challenges. At the same time, we feel that, given the new structure, the visibility of the core conservation function of the CePaCT genebank is somewhat diminished by its integration across the different themes in the Genetic Resources Pillar which seems to prioritise a utilitarian function of the genetic resources through propagation, breeding and seed systems. CePaCT needs clear visibility within the structure of the Genetic Resources Pillar to demonstrate its role in terms of serving as a regional hub for conservation and use of genetic resources in the Pacific region, a role that is recognised internationally.

It is evident that more work is required to improve performance. Reviewing the workflow in the genebank is a high priority. We observed that the current work priorities in the genebank and its management are more geared towards multiplication and distribution of genebank materials to meet the needs of member countries and/or various projects (often in response to disaster situations). While we agree that this should be a key function of the genebank, in terms of making germplasm available, it should not do so at the expense of its core function

as a facility for the long-term conservation of diversity of edible aroids and other crops. These present activities of multiplication and distribution have resulted in the CePaCT genebank not meeting the conservation performance indicators as set up by the Crop Trust and thus have jeopardised the long term funding agreement from the Crop Trust in securing its collection. Further it is not meeting its obligations with regards to the agreement signed with the International Treaty in relations to Article 15. This is a risk that SPC should not take.

It was apparent that a new workflow needs to be devised and implemented that is more efficient, safe and less time consuming. Such a system would need to be mindful of how much and when new acquisition material will arrive at CePaCT, it would require the materials to be immediately documented, registered and bar-coded for their future tracking. In addition, such acquired materials should firstly be grown in a holding facility where they can establish, then virus indexed once an appropriate maturity stage has been reached. Once indexed, and found to be clean, vegetative tissues can be brought into aseptic culture in the CePaCT facility and safely multiplied, with some of the resulting cultures going onto a slow growth medium and placed into a room dedicated to long term culture conservation, while others are kept in an active collection for future multiplication and distribution to clients. Once in culture, both the active and conservation collections will need to be monitored for health and sub-cultured at appropriate times. However, the number of sub-culture steps applied should be reduced to no more than 10 cycles before new cultures are re-established from the parental materials growing in the holding facility or recollected from the field.

Once materials are distributed to clients, CePaCT must also obtain field verification data showing that the planting materials are remaining true-to-type. Further, the new workflow must build in an approach to safely duplicate the materials in the conservation collection. Such duplication could take place through culture exchange with another regional genebank and/or be maintained as a long term cryopreservation collection in CePaCT. The review team consider cryopreservation of the aroid collection at CePaCT to be a simple option given that highly effective techniques are available and that CePaCT themselves have already generated cryopreservation collections.

The review team was impressed by the ability of each individual technical staff to multi-task to carry out all activities in the genebanks (from media preparation, vessels cleaning, explant extraction, sub-culturing, conservation monitoring etc.). This allows the team to be flexible and able to cover for colleagues who are on leave and allow the team to cope with staff departures. This is very commendable. However, it is important that for each of the steps in the workflow, there needs to be up to date SOP and manuals that clearly describe the techniques and protocols to ensure consistency in the methodology used by different staff. The use of videos that demonstrate how to techniques needs to be applied is also recommended.

There is also a need to support the further development of new and existing staff of the genebank through additional training, refresher courses, more advanced training so as to keep the staff up to date with the latest techniques of tissue culture, genebank management, new conservation methods, cryopreservation etc. It is also very important that the technical people do not work in isolation and are able to be assisted by peers in their respective domains to allow them to exchange their experience and get assistance when they encounter problems. The review team recommends that a twinning arrangement with an internationally reputable institution be established to allow such exchanges to take place.

### Purpose of the Review

This review is being carried out in the context of the long-term grant agreement from the Global Crop Diversity Trust (Crop Trust) to the SPC's Centre for Pacific Crop and Trees (CePaCT) genebank for the conservation of the internationally recognised collections of taro and yam diversity for the Pacific region. The review aims at assessing the efficiency and

effectiveness of the management of the genebank's operation as a whole, the conservation status of the supported collection, and the status of the genebank within the context of the host institution (that is, within SPC's Land Resources Division strategic plan) as well as within the global system for the conservation and use of the crops concerned vis-à-vis the commitments to Article 15 of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and Food and Agricultural Organization of the United Nations (FAO) second Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (GPA2).

The specific objectives of the proposed review of SPC's CePaCT are to:

- Assess the effectiveness and efficiency of the management, operations, facilities, and activities of the CePaCT genebank.
- Assess the roles, services and use of the CePaCT genebank, and the linkages with users and other partners.
- Review the status of the CePaCT genebank with respect to performance targets and the feasibility of proposed work plans to reach targets.
- Consider the status of individual collections maintained by the CePaCT genebank in the context of a global system for long-term conservation and use of the crops in question.
- Provide actionable recommendations and pathways for the strengthening of the CePaCT genebank's operations within Fiji and its linkages to member countries in the Pacific, based on perceived country needs.

The external reviewers were Ehsan Dulloo (specialist in conservation and use of plant genetic resources) and Stephen Adkins (specialist in tissue culture/*in vitro* conservation). The Terms of Reference (TOR) of the reviewers are found in Annex 1.

Paula Bramel facilitated the reviews for the Crop Trust. She provided background information, worked with the reviewers to develop the agenda, and coordinated the execution of the review on site. The Crop Trust facilitator participated in all review sessions, except the meeting with Pacific Tree Seed Centre and has overseen the completion of the final report. It should be emphasized that the Crop Trust did not take part directly in the formulation of the review report and recommendations.

The reviewers received a set of background documents (Annex 2) to examine prior to the site visits in Suva, Fiji and Apia, Samoa.

### Methodology of the Review

The review is part of the on-going granting agreement between the Crop Trust and SPC's CePaCT genebank for the conservation of the internationally recognised collections of taro and yam diversity for the Pacific region. The review aims to assess the efficiency and effectiveness of the management of the genebank's operations as a whole, the conservation status of the collection, and the standing of the genebank within the context of the host institution, SPC.

The review began in June 2017 with a "desk study" of documents provided by Crop Trust (Annex 2) that included the long term granting agreements, SPC strategic plans, country reports on germplasm evaluations of CePaCT materials, capacity building activities at CePaCT and other reviews undertaken at SPC (see list below).

To support the information gathered from the desk study, country visits were made to Fiji and Samoa in July 2017. During these visits the staff of SPC and CePaCT, Government Research Organisations, and a University were met. The present report is therefore a summation of the desk study and the country visits.

The programme of the site visits in Suva and Apia are given in Annex 3.

### Strategic Positioning of the CePaCT Genebank within SPC

The CePaCT genebank is managed under the SPC Land Resources Divisions (LRD), whose objective is to improve the food and nutritional security of the Pacific through the sustainable management and development of land, agriculture and forestry resources. To this end, SPC LRD maintains in its CePaCT genebank a significant collection of edible aroids genetic resources important for the food security of the people of Pacific and beyond. This collection is also important globally for national, regional and international agricultural research, development and production programmes all over the world. In recognition of its global importance, SPC has placed its collection in the multi-lateral system under Article 15 of the Treaty and has signed an agreement with the Governing Body of the ITPGRFA to that effect, thereby contributing its role in the conservation of PGRFA as part of a well-defined component of a rational, co-ordinated, forward-looking global system. It also committed itself to ensuring (1) to upgrade its genebank facilities and operation and (2) sustainable funding to maintain its standards to international norms so as to continue benefit for long term funding support (in perpetuity) from the Global Crop Diversity Trust.

Currently, SPC LRD is re-organising its structure into four pillars, namely those of Genetic Resources, Sustainable Forests and Landscapes, Sustainable Agriculture for Food and Nutrition Security, and Livelihoods and Value Chains. Within this new structure, the CePaCT genebank sits under the Genetic Resources Pillar, which includes the following key themes:

- Conservation and propagation (Aroids)
- Genetic diversity: Crops/Trees/livestock
- Developing, evaluating and trialling climate smart varieties
- Breeding and seed systems
- Community based seed systems

The review team feels that, given this new structure, the visibility of the core conservation function of the CePaCT genebank and of its role in ensuring the safety of global collection under its responsibility is somewhat diminished by its integration across these different themes, which seem to prioritise a practical function of the genetic resources collection through its propagation, distribution and via seed systems. CePaCT's activities need to be given more visibility within the structure of the Genetic Resources Pillar to demonstrate its role in serving as a regional hub for conservation as well as the use of genetic resources in the Pacific region.

#### Recommendation 1:

**The review team recommends that LRD management add an additional thematic area under the Genetic Resources Pillar and the second thematic area reworded to prioritize to the multiplication and distribution function, so that the set of thematic areas under Genetic Resources Pillar would read as follows:**

- **A long term conservation facility for the Pacific region (CePaCT)**
- **Multiplication and distribution**
- **Genetic diversity: Crops/Trees/livestock**
- **Developing, evaluating, and trialling climate smart varieties**
- **Breeding and seed systems**
- **Community based seed systems**

### Review of the Operational Procedures of the CePaCT Genebank

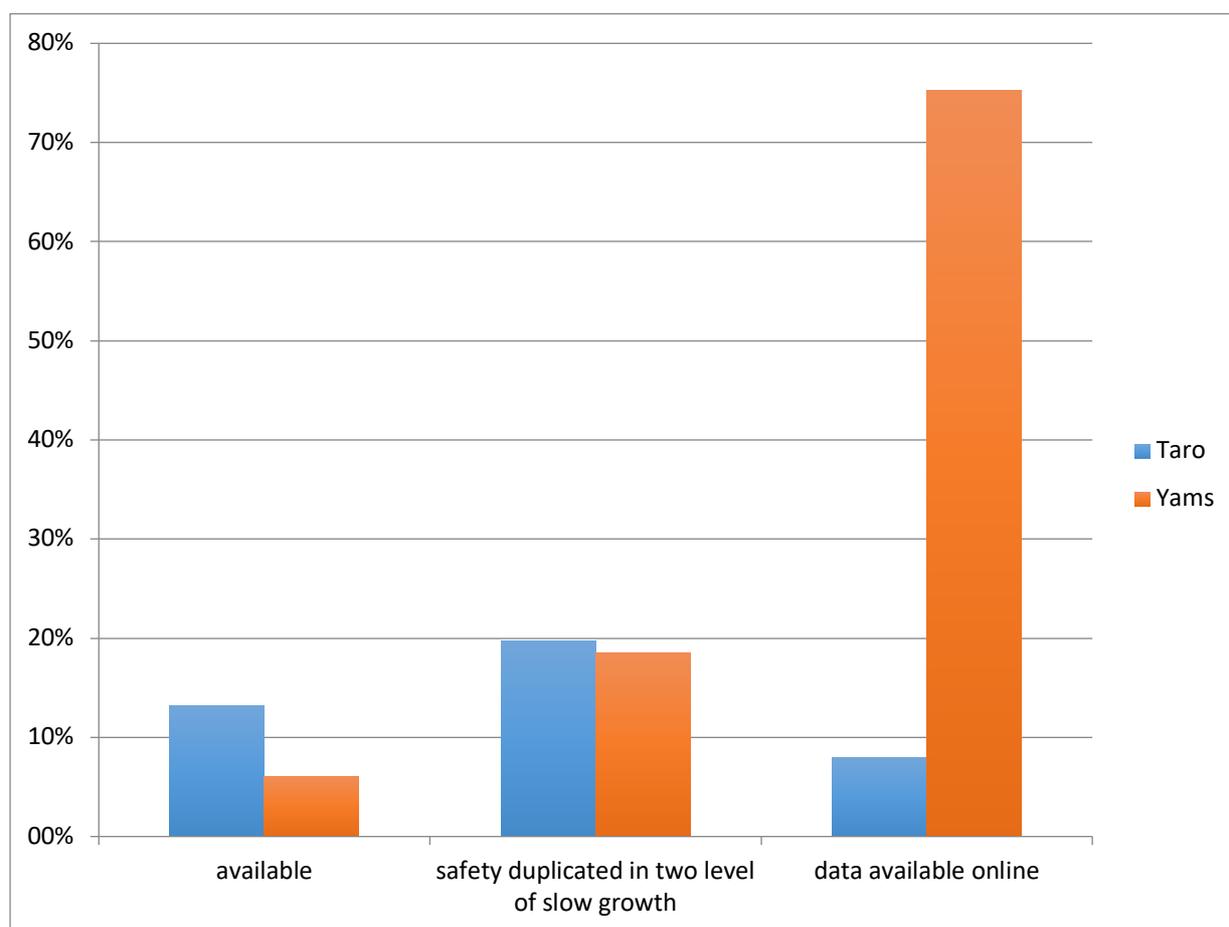
The Crop Trust, in collaboration with the CGIAR Institutes, developed a set of key performance indicators and targets to monitor the annual status of the conservation operation in the Crop Trust supported genebanks (Table 1). The key performance targets that genebanks need to meet and maintain to benefit from long term funding from the Crop

Trust are provided in Table 1. The targets dictate that 90% or more of the accessions in collections should be immediately available for distribution, secured in safety duplication and documented online. The CePaCT genebank falls short in all of the targets for all the key performance indicators relating to availability, security and data availability except for yams data availability (Figure 1).

**Table 1:** Performance targets which genebanks need to meet and maintain to benefit from long term funding from the Crop Trust.

Indicators		Targets
1	Percentage collection which is clean of pathogens of quarantine risk, viable, and in sufficient quantity to be immediately available for international distribution from medium-term storage (or local distribution for some tree spp.).	<u>Availability</u> 90% accessions available
2	<b>For seed crops:</b> Percentage collection held in long-term storage at two locations and also in Svalbard Global Seed Vault (except for tree spp.). <b>For clonal crops:</b> Percentage of the collection held in long-term storage or cryopreservation at two locations; % of the collection held in slow growth conditions <i>in vitro</i> at two locations.	<u>Security</u> 90% seed accessions safety duplicated 50% clonal accessions in cryopreservation Intermediate target 90% accessions duplicated in <i>in vitro</i>
3	Percentage collection with minimum passport and/or characterization data online	<u>Data availability</u> 90% accessions documented
4	Quality Management System	<u>QMS</u> Agreed elements of QMS/ISO are in place

**Figure 1:** Performance of CePaCT genebank in 2015 with regard to performance indicators for availability, security and data availability for taro and yams

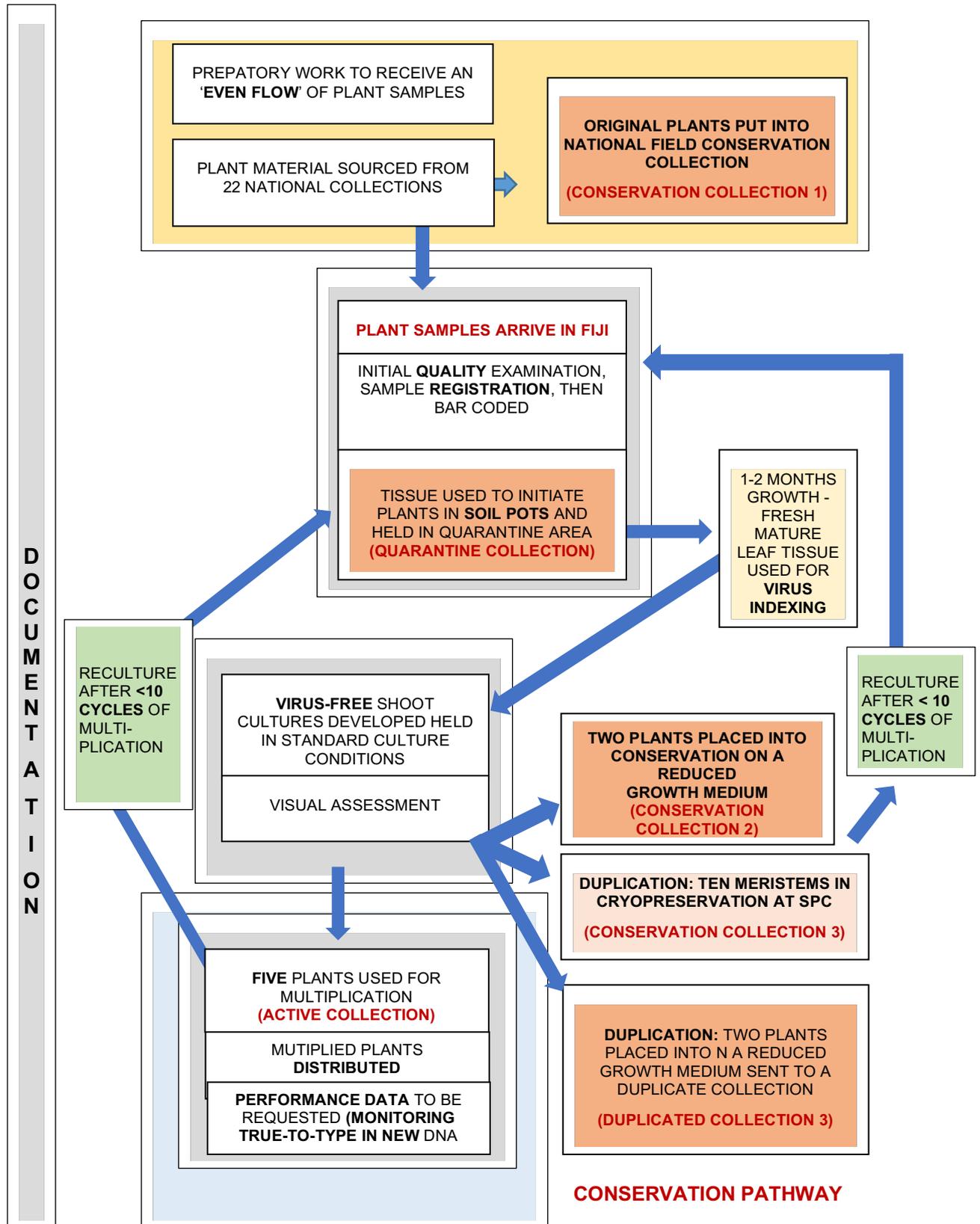


The last year that CePaCT completed annual reports in the ORT was in 2015. The 2016 report is still pending from SPC. When the performance of CePaCT in 2015 is assessed in relation to the target for the first three performance indicators (Figure 1), it is clear that there is still a lot of progress required to enable the CePaCT genebank to reach the agreed targets. CePaCT does not currently have QMS established. The review team believes that CePaCT should aim to improve its standards toward the targets that have been established for the CGIAR genebanks and that by implementing the revised workflow (see next section) and the recommendations in this report, the performance of CePaCT genebank will rapidly be improved.

**Workflow in the CePaCT genebank:**

It was apparent that a new workflow needs to be devised and implemented in the CePaCT genebank, a system that would be less time consuming, providing for better safety to the conservation collection, and reducing the chances of somaclonal variation appearing in the multiplied and conserved materials (Figure 3). Such a system would need to be mindful of how much and when new acquisition material will arrive at CePaCT, it would require the materials to be immediately documented, registered and bar-coded for their future tracking.

**Figure 3:** A new workflow for *in vitro* genebank work as proposed for germplasm conservation and utilization at SPC CePaCT.



In such a new workflow, newly acquired materials should first be placed in a remanding facility where they can be grown and virus-indexed before any tissues are brought into the laboratory and put into aseptic culture. One area identified by the reviewers that could be used for this purpose of germplasm containment, and requiring of little modification, is the old tennis court that runs alongside the CePaCT laboratory. This large, flat and fenced area would be ideal for holding a sizable collection of potted plants under protected conditions prior to virus testing and culturing. This same collection would also be used for the re-establishing further *in vitro* cultures once the present cultures had been sub cultured for about 10 cycles (see Recommendation 4).

The cultures, once multiplied, would be divided, with a proportion going onto a slow growth medium and placed into a room dedicated to conservation. The other cultures would be maintained on a standard medium and placed into an active collection, in a separate room, used for multiplication and plantlet distribution to clients.

Once in culture, both the active and conservation collections would need to be monitored for their health and sub-cultured at appropriate times. However, the number of sub-culture cycles used should not exceed 10 before new stock cultures are re-established from the parental materials from either the holding facility or from materials recollected from the field. Once materials are distributed to clients, CePaCT staff must also obtain field verification data showing that the planting materials sent out are remaining true-to-type.

Further, and most importantly, the new workflow system must build in a step (or steps) to safely duplicate the conservation materials using a second technique, or the same technique in a second location. The latter form of duplication could take place through a culture exchange program with another regional genebank, such as the new facility being built at Nu'u by MAF in Samoa, while the former form could be achieved through the development of a long-term cryopreservation collection at CePaCT. The review team consider cryopreservation of the aroid collection at CePaCT to be a simple option given that highly effective techniques are now available for most edible aroids and because CePaCT has in the past developed cryopreservation technology for aroids (see Appendix 2).

The review team feels that the following four improvements could be made to the current workflow;

**1) Comprehensive System for accession information collection and exchange:** In order to facilitate conservation and use of germplasm by end-users, it is necessary that information on the origin, characteristics and performance of the plant material is collected, maintained and made readily available to anyone who needs it. To undertake such activities the establishment of 1) a barcoding system will be required to track the standard operations applied to the accessions in their routine maintenance and conservation, and 2) a better documentation system to efficiently capture accession information in a form that is easily available to the recipients of the germplasm and can hold data feedback from others who have used the germplasm. Such a system of barcoding and documentation will allow staff to access information at all times including passport data, management procedures used, health evaluation, and finally field performance. Such a management system will reduce the present workload used for collecting and storing and retrieving data.

**Recommendation 2:**

**The review team recommends that a barcoding system be used that can better manage and track the routine operations applied to the accessions for their conservation (see also Recommendation 5 concerning an accession level documentation system).**

**2) Health Status of Accession:** Virus infected materials should not be introduced directly into the CePaCT active or conservation collection as this may compromise the viability of these collections. The laboratory should aim to hold all arriving germplasm in a quarantine holding area until viral indexing is completed by the CePaCT virology laboratory. Once certified virus-free, materials can then be introduced into aseptic culture and placed into the collections.

**Recommendation 3:**

**The review team recommends that all arriving germplasm should first go into a quarantine holding area, possibly the old tennis court alongside the CePaCT laboratory, until viral indexing can take place. Once certified virus-free, materials can then be introduced into aseptic culture and placed into the collection.**

**3) Germplasm Quality:** It has been the present practice of the CePaCT laboratory to produce plantlets for clients by multiple sub-culturing from the same mother cultures. Such practices applied over several years will have invariably resulted in somaclonal variation occurring and therefore the present plantlets being produced and those in the conservation collection may not be true-to-their-original-type. It may be necessary for the proposed CePaCT molecular biology laboratory to undertake research, using molecular marker technology, to identify the trueness to type of cultures produced after different numbers of subcultures. Such information would then enable CePaCT staff to better predict when to stop sub culturing from the same mother cultures. Until otherwise determined, we recommend that sub culturing of both the active and conservation collections should not go beyond 10 cycles before new cultures are re-established from the quarantine collection.

**Recommendation 4:**

**The review team recommends that re-culturing of both active and conservation collections should not go beyond 10 subcultures before new cultures are re-established from newly sourced material from the field or the quarantine collection**

**Documentation**

The CePaCT germplasm management data is fully described and reviewed in the report by Michael Mackay "Report on status of information management at CePaCT" 24 to 26 March 2015. Mackay carried out an assessment of the status of and gaps in the CePaCT information management system. He described the current system employed by CePaCT and identified the key constraints as a lack of suitable qualified personnel, available time to properly manage data, no data integration across genebank activities, lack of data standards and no effective Information Technology (IT) tools to facilitate efficacy of genebank flows with data management. He recommended the implementation of a stepwise strategy to facilitate the quality and integration of data, including:

1. Passport data standards,
2. Importation and distribution data management activities to be in line with the workflow,
3. Address characterisation and evaluation data,
4. Develop an operational manual of standard operations and
5. Involve the personnel inputting and maintaining data in design of the use interfaces.

The review team feels that by adopting the genebank barcoding system (see recommendation 2), many of these concerns would be addressed. The automated documentation system should also be compatible with the Online Reporting Tool (ORT) of the Genebank Platform to facilitate and speed up reporting, while saving valuable reporting time of the staff.

It was also recommended by Mackay that a documentation and database consultant position be filled to facilitate a smooth transition towards the development of an integrated documentation system, including a bar coding system. The review team supports this recommendation.

**Recommendation 5:**

**The review team recommends that a documentation and database consultant position be recruited to strengthen the implementation of the barcoding system, advise on the development of the documentation system and ensure a smooth transition towards its application in the genebank. The review team believes that such a position will be critical to allow CePaCT to achieve an international standard in genebank documentation and information management. (see also recommendation 12).**

**Recommendation 6:**

**The review team is in full agreement with Mackay's third recommendation, in that CePaCT should adopt a number of easily deployable standards for their passport data, including FAO/Bioversity Multi-crop Passport Descriptors, the three-character ISO 3166-1 country codes, FAO WIEWS Institute codes and USDA GRIN Taxonomy.**

**Impact of the Distribution of Planting Materials from the CePaCT Genebank**

The review team took note of the draft report of Grahame Jackson and Peter Walton on the review of distribution and evaluation data from SPC Plant CePaCT (desk study) and comments from the genebank staff on the difficulties they encounter in getting feedback on the use of the germplasm they distribute. From our assessment of the quality of the work being performed by CePaCT staff, it is evident that CePaCT staff is spending significant core resources in preparing and distributing large amounts of high quality germplasm for free to its member countries and beyond for evaluation in response to emergencies. CePaCT distributed 4,500 accessions (42,000 plants) to Pacific countries and other regions between the years 2009 and 2015 (Jackson & Walton, draft report). Countries and partners whom the review team have contacted confirmed that the CePaCT genebank has been very responsive to the requests of countries for germplasm. However, it seems that there are major problems at the recipient level for the successful uptake of these materials in terms of their capacity to receive and adequately evaluate the quality of such materials. The end result is that farmers are not benefiting from the CePaCT material, contrary to the intended goal of the CePaCT programme. Recipients are also not providing feedback on the evaluation of materials that they have sent out for a number of reasons, including lack of a regional policy towards evaluation, insufficient awareness of what is involved, concerns with biosecurity, reluctance to share, poor infrastructure and lack of funds.

CePaCT has also designated a "climate-ready" sub collection of 113 accessions that have demonstrated tolerance to drought, salinity, waterlogging, and other climate related stresses. However, a survey carried out to test the effectiveness of this collection has shown no concrete evidence of the effectiveness of this climate-ready collection, which may be due to poor evaluation of the collection.

In light of the above, the review team questions whether CePaCT should continue to invest its core resources in producing planting materials for large-scale distribution, if there are doubts about successful adoption by farmers. The review team is in agreement with the recommendations expressed by Jackson and Watson that a short-term moratorium on further distribution for evaluation be put in place and that a new policy be developed for distribution of CePaCT germplasm. CePaCT should not be sending out large quantities of germplasm materials blindly to countries and should ensure that recipients are able to adequately handle and evaluate materials received and provide feedback to them.

**Recommendation 7:**

**The review team recommends that no distribution be made until due diligence is made of the capacity of recipients to adequately receive, establish and evaluate the materials.**

**Recommendation 8:**

**The review team further recommends that CePaCT prepare a written agreement for recipients of germplasm for evaluation to sign before any request is approved. The agreement should request the recipient to send a report to CePaCT on the condition of material received and a report on the characterisation and evaluation results, as they become available so as to increase the value of the collection.**

**Recommendation 9:**

**Further CePaCT should develop a simpler evaluation data form to help recipients to provide feedback on the evaluation data. As is possible, digital means for capturing information (including photographic images) should be promoted.**

**Risk management:**

The review team discussed with CePaCT staff the measures taken to ensure the security of genebank collections. It is clear that the risk assessment of the facility itself is well taken care of by the OHS committee of SPC LRD. They have regular drills, and the equipment, and generators etc. are all well serviced institutionally by the SPC LRD. CePaCT genebank management has established a good monitoring alarm system for its high temperature cut off. Staff are organised on a roster for checking AC units and equipment. While this work should be commended, the review team feels that access to the conservation collection should be made more secure, and the use of unprotected UV lighting to aid sterilization of surfaces in the main culture lab was dangerous and probably not at all effective, and therefore a full risk management system and Quality Management System (QMS) should be put in place. The genebank lacks a contingency plan to act in the event of major threats to the cultures.

**Recommendation 10:**

**The review team recommends that CePaCT hire a consultant on risk management, with international experience on tissue culture labs to advise and oversee the preparation of a risk management plan and contingency plan. The Crop Trust should be able to advice CePaCT on the consultant.**

**Recommendation 11:**

**Further it recommends that a shipping container with power generation be acquired and placed alongside the CePaCT genebank to serve as a refuge for cultures in the event of future natural disasters such as cyclones (see also Recommendation 20 - post-cyclone Winston).**

**Staff – training:**

The review team notes that the CePaCT genebank has suffered a lot from the reduction of genebank staff over the last few of years. It notes that since the departure of Mary Taylor as the coordinator and CePaCT manager, her position has not been properly filled. Existing staff of the genebank were deployed to serve as coordinator and the curator in an acting capacity. Other staff have left or gone on study leave, while there has also be a change of the human resources (HR) policies at SPC to meet the Fiji new labour law relating to the employment of temporary staff such that the contracts of several temporary staff could not be renewed. All of this has not allowed for the provision of an adequate staffing profile to the genebank to fulfil all of the services of the genebank.

### **Recommendation 12:**

**The review team recommends that given the core responsibilities of the genebank, the SPC should recruit the following permanent positions:**

- **A CePaCT genebank coordinator (international position)**
- **A curator**
- **A documentation and data officer**

In addition, a staffing profile of at least four technical officers and six assistants is required to run CePaCT primarily as a conservation facility, but with the capacity to provide planting material to clients in a calculated and measured fashion.

There is also a need to support the further development of new and existing staff of the genebank through additional training, refresher courses, more advanced training so as to keep the staff up to date with the latest techniques of tissue culture, genebank management, new conservation methods, cryopreservation etc. It is also very important that the technical people do not work in isolation and are able to be assisted by peers in their respective domains to allow them to exchange their experience and get assistance when they encounter problems.

### **Recommendation 13:**

**The review team recommends that a twinning arrangement with an internationally reputable institution be established to allow such exchanges to take place.**

[Assess the Roles and Services and use of CePaCT Genebank and the Linkages with Users and Partners](#)

Besides its role in long term conservation and making materials available for distribution, CePaCT genebank has a great potential in providing additional services to users of genetic resources and other stakeholders:

- Its virus indexing lab is fully functional and when properly staffed can provide a service for screening viruses from plant materials for breeding programmes in the region, for example for the national partners in Samoa.
- The CePaCT laboratory and facilities can be used as a centre for capacity building of national partners. It was evident from our visit to Samoa that the national programme and that at the University of South Pacific (USP) were in dire need for the local staff to get training on the TC techniques undertaken at CePaCT. This will also enable peer to peer interactions and lead to stronger collaboration between national programmes and CePaCT genebank staff.
- CePaCT is envisaging the establishment of a DNA fingerprinting laboratory and nutrition laboratory under project funds. Once established and adequately staffed, these facilities can provide DNA fingerprinting and nutritional analysis for other programmes within SPC and for other stakeholders in the region.
- The Bioreactor facility established in the CePaCT is a great asset that can be put to work for scaling up the production of planting material for distribution at a lower staff input requirement.
- CePaCT genebank can be used as an educational centre of learning for raising awareness among school children and also to support research activities for university student at undergraduate and postgraduate levels.
- The potential establishment of a cryopreservation facility (see above), can also service the conservation of other agrobiodiversity including animal genetic resources, fish genetic resource and can be used to back up collections of other institutions /programme/centres.

- The CePaCT genebank can also provide a service for Pacific Tree Seed Centre. The review team visited the facilities at the Pacific Tree Seed centre and observed that it is very much under-resourced in terms of staff, but has some valuable equipment that can be of benefit for CePaCT genebank.

**Recommendation 14:**

**The review team recommends CePaCT explore how it might offer a number of valuable services potentially as a source of income, but not at the expense of the core conservation and use functions and should only be carried out on a full cost recovery basis.**

**Recommendation 15:**

**The review team recommends that within SPC LRD, the Pacific Tree Seed Centre be integrated and CePaCT genebank and facilities including staff and equipment between the two conservation facilities be shared to mutual benefit under one management.**

**Status of CePaCT collections in the context of global system of conservation and use of the Pacific crops (and trees)**

As mentioned before, the CePaCT genebank holds a unique diversity of edible aroids and yams that are of global importance and have been included under the Multilateral System of Access and Benefit Sharing (Article 15) of the International Treaty on PGRFA, and as such forms part of the FAO global system of conservation and sustainable use of PGRFA. In this review we examine the extent to which the CePaCT genebank is contributing to and meeting its obligations to the global system, particularly with reference to its reporting to the International Treaty, Crop Diversity Trust's long term agreement and its support in the implementation of the FAO second Global Plan of Action for the conservation and sustainable use of PGRFA. .

**Reporting to the International Treaty on PGRFA:**

The obligations of the depositors to the MLS of the International Treaty involves the reporting on the number of accessions of their collection on MLT being distributed using the Standard Material Transfer Agreement.

Article 3.3b defines the activities that SPC should undertake to further the development of the global system for PGRFA. These include:

- Extending the coverage of genepools ex situ (including analysing and filling gaps in collection of germplasm available under the treaty, including the SPC in trust collection) in partnership with others.
- Providing training and capacity building
- Partnering with other genebank and networks in the context of creating a more efficient and effective global system,
- Providing conservation service to others
- Developing links to users and promoting use.

The review team notes that CePaCT has made great efforts to extend coverage of their genepools and new crops (as budget permits) by importing new materials from various countries including taro from Vietnam and Philippines, yams from Fiji, banana from Taiwan. It also has plans to extend the coverage from other countries and for other crops. Much of this though was achieved through the Crop Trust regeneration project. The centre has met with their commitment for providing training and capacity building to their members. Over the past 5 years, many courses have been run by the genebank staff to provide training to national staff from Vanuatu, Samoa, Tuvalu, Fiji, as well as to their own staff. The range of

subjects includes plant virus indexing, nursery development, transfer of TC plants, new techniques for TC using bioreactors, screening for climate resilient crops and seed germination.

The centre is also doing very well in providing materials to national programmes and other users. More than 80,000 plants of taro, sweet potato, banana, and other aroids in the form of tissue culture plantlets have been distributed to over 51 countries worldwide, which is a great feat. Partners of Pacific community seem to be very happy with the responsiveness of the CePaCT genebank to their request for germplasm. However, there are some concerns about the effectiveness of these efforts and this may undermine efficiency and effectiveness in contributing to the rational global system.

At this moment in time, one of the biggest constraints of the CePaCT genebank in contributing to global system is lack of leadership, which is due to the departure of CePaCT coordinator and the frequent changes in the management of the centre. The current staff is working hard to keep the genebank functional, but are unable to go further in developing strategic linkages with other genebank and networks. However, limited linkages with other global research institutes were achieved through the EU INEA project. There is a dire need to recruit the CePaCT Project Coordinator who would provide the strategic vision in developing partnerships with other centres and network. Also, the twinning arrangement as recommended earlier may help in this endeavour.

**Recommendation 16:**

**The review team recommends that the CePaCT coordinator position with international experience be filled as a long-term appointment as soon as possible. Besides heading the genebank and being responsible for the overall management of the genebank, the coordinator should also have the responsibility in developing global partnerships with other centres and network and contribute to the global objectives of the International Treaty and FAO's global plan of action. (see also Recommendation 12-staff)**

**Facilitating role to reporting on the Second GPA:**

The FAO Global Plan of Action (GPA) for the conservation and sustainable utilization of PGRFA has been the main reference document for national regional and global efforts to conserve and use PGRFA sustainable and form part of the global system for the conservation and use of PGRFA. The first rolling GPA was adopted by the FAO International technical Conference in Leipzig in 1996 and was updated by the Commission on Genetic resources for Food and Agriculture following the publication of the second state of the world report on PGRFA in 2009. The second GPA was approved at the 13th regular session of the CGRFA in July 2011 and adopted by FAO council in December 2011. The second GPA provides a set of 18 inter-related Priority Activities to enhance the efficiency of PGRFA conservation and improve the utilization of plant diversity, organized in priority areas relating to in situ conservation and management, ex situ conservation, sustainable use and building sustainable institutional and human capacity. Guided by governments and other FAO members, through the CGRFA, a monitoring mechanism composed of a set of 63 indicators and a reporting mechanism has been put in place by FAO to track the progress in the implementation of second GPA by countries. Countries and regional programmes are required to provide regular report to FAO through online reporting mechanism called WIEWS. Most of the countries in the Pacific region are members of the CGRFA and have endorsed the second GPA and are required to submit their report to the FAO through WIEWS.

**Recommendation 17:**

**It is recommended that CePaCT genebank supports SPC member countries in achieving the implementation of the Second Global Plan of Action for the**

**Conservation and Use of PGRFA, as part of the global system, specifically for the priority activities for ex situ conservation, in serving as safety backups for the national collections, in building capacity and in promoting use of PGRFA of importance in the region.**

[Review of the strengthening of crop conservation post cyclone Winston.](#)

On the request of the Crop Trust, the review team assessed the objectives and proposed activities as well as the progress made on the implementation of the project “*Review of the strengthening of crop conservation post cyclone Winston*” funded by The Crop Trust to the tune of US\$72,796. The aim of the project is to rehabilitate CePaCT genebank including infrastructure and conservation equipment following damages caused by Tropical Cyclone Winston in February 2016 and to update the directory of the Pacific crop collection. The project has the following three main objectives:

**Objective 1:** *To assess cyclone damage and provide support to refurbish CePaCT's crop conservation equipment and infrastructure.*

**Objective 2:** *To strengthen restoration and security of the Pacific regional breadfruit plot in Fiji damaged by the cyclone.*

**Objective 3:** *To conduct a survey on the impact of past and recent cyclones on Fiji and Pacific genebank collections, including updating of the PAPGREN Directory of Pacific Crop Collections, and acquiring of threatened crop varieties for conservation at CePaCT.*

With regard to **Objective 1**, the review team inspected the physical building of the genebank and held discussions with the genebank staff to determine which equipment was damaged and has been replaced and which ones are still pending. It was reported that the air conditioning units in screen houses were damaged by water infiltration and these have been replaced and are now fully functional. It is also intended to replace the dehumidifiers in the growth rooms. The review team questioned whether these were necessary since the rooms are fitted with air conditioning systems and if these are functioning well, dehumidifiers may not be necessary. However, the genebank curator argued that droplets of water are observed on the walls of the growth room during high humidity periods and these can be a source of contamination due to the proliferation of fungus. In order to ensure the security of the cultures, it is important that the humidity in the room is contained and a dehumidifier is warranted in such a case. The review team also examined the external building, the insect screen to the screen house and found no damage.

**Recommendation 18:**

**The review team recommends that humidity within the growth room be monitored and to check to see if the air conditioning is functioning properly and effectively reducing humidity in the room, before purchasing dehumidifiers.**

The review team observed that the activity “acquiring new crop varieties (breadfruits, aroids yams, bananas and sweet potatoes)” did not fit the first objective and should be considered under Objective 3.

**Recommendation 19:**

**It is recommended that CePaCT should carefully evaluate the need for acquiring new accessions of other priority crops consistent to their mandate in relation to threats from cyclones and climate change. However, high priority should still be given to aroids, yams and breadfruit.**

The review team discussed the evacuation plan for cultures during natural disaster situations with the genebank staff. It was suggested that a large shipping container be acquired under

the project and converted to a safety room where cultures could be kept during cyclonic conditions. CePaCT has recourse to services at LRD that can undertake the conversion and make the necessary electrical connection and have access to reliable standby generators. A quotation of the containers have been made and would cost between 2,000 to 4,000 FJ\$ depending on the condition of the container.

**Recommendation 20:**

**The review team fully endorses this idea and strongly recommends that, given the long term mandate of the genebank, a new large container (rather than an old container) with power generation be acquired and strategically located next to the genebank building in the space occupied by the unused “tennis court”. This location is ideal for the quick evacuation of the cultures. This recommendation also addresses the mitigation of risks of natural disasters that are likely to damage the genebank collection. The review team also recommends that this space can be used during safe periods for other genebank activities. (see also Recommendation 2 and 11)**

With regard to **Objective 2**, the review team visited the collection of the Pacific regional plot of breadfruit in quarantine area and was able to take stock of the damage to the breadfruit trees in the collection. All of the trees have recovered and trees that were uprooted during the cyclone were placed back and tied down. The review team agree with the activities proposed under this objective are necessary and should be implemented. However, it was suggested that concrete not be put around the base of the affected trees to prevent them from being damage in future cyclone/strong winds.

**Recommendation 21:**

**The review team recommends wire guides or props are installed to support the weak trees and firmly attached in concrete at four opposite sides of each tree. This will allow water to seep through the soil more easily and not to have a permanent concrete cover over the ground.**

**Recommendation 22:**

**The review team further recommends that duplicates of each of the breadfruit accessions be propagated and kept in pots in field genebank to be established, as a precautionary measure, in case accessions are lost.**

Concerning **Objective 3** the review team agree that activities proposed are necessary and should be implemented. As mentioned under objective 1 above, the activity on acquiring new varieties should be moved under this objective.

**References**

Mackay M., 2015. “Report on status of information management at CePaCT” 24-26 March 2015. Report to the Global Crop Diversity Trust.

**Acknowledgements**

The Review Team would like to record its sincere thanks to all those who have made our job possible and a pleasant exercise. Dr Jan Helsen (Director, Land Resources Division, Pacific Community SPC) for his warm hospitality in Suva and readiness to meet with the review team and Crop Trust Coordinator for discussions. Ms. Logotonu Waqainabete (Officer in Charge/Curator of Centre for Pacific Crops and Trees CePaCT genebank) for the organisation of our meetings for this review to take place in the best of circumstances, compiling information, and for coping with our many probing questions on the genebank management and its activities.

In Fiji we wish to thank Ms Reapi Masau for her tireless efforts to organise our meetings, order taxi, organise coffee breaks and lunches with delicious traditional Fijian food. Ms

Ulamila Lutu for supporting our review, assisting us with field visits at the Koronivia Research Station (KRS), Ministry of Agriculture and for driving us around for the field visits, to our hotel and airport. All of the staff of the CePaCT genebank (A. Fui, A. Shandil, L. Rokodua, M. Ravulo, N. Sai Ofa, P. Masau, R. Masau, R. Parsad, S. Cakaunitavuki and R. Devi) for attending and participating in our review meetings in CePaCT and responding to any queries we had. Ms Elina Young Pacific Tree Seed Centre (PTSC) for her availability and presentation on the work of PTSC and for guiding us in the visit of the Tree Seed Centre. Mr. Savenaca Cuquma (Principal Agronomic Officer) and other staff for guidance in the visit of Tissue Culture Labs of KRS, Ministry of Agriculture and their field collections.

In Samoa we wish to thank Mr. Tilafono David Hunter, CEO Ministry of Agriculture and Fisheries (MAF) of Samoa and Mr. Moafanua Tolo, acting CEO Crop Division MAF, for meeting with us and discussing the work on priority crops in Samoa and their relationship with SPC and the CePaCT genebank. Mr. Pueata Tanieilu Principal Development Officer, Mr. Aleni Uelese, plant breeder at the Crop Division Research Station to guide us during the field visit to the taro breeding programme and through the new Tissue Culture Unit under construction. The Head of the School of Agriculture and Food Technology, Associate Professor Mohammed Umar, of The University of the South Pacific (USP) for his warm hospitality at USP and helping us view the Tissue Culture Unit at USP, and Dr Elena Martin Avila visiting scientist at the Crop Division MAF for guidance on the present germplasm collection and future direction of MAF's Tissue Culture Unit.

The review team would like to thank Dr Paula Bramel (Global Crop Diversity Trust) for her constant guidance throughout this assignment. She coordinated the review process, helped to clarify the expectation of the Crop Trust and provided all the background documents needed to allow us carry out the review. She also accompanied us to Suva, Fiji and Samoa to introduce us to the various partners

### Abbreviations

CePaCT	Centre for Pacific Crops and Trees
CT/GCDT	Global Crop Diversity Trust
FAO	Food and Agricultural Organization of the United Nations
GPA	Global Plan of Action
HR	Human resources
IT	Information Technology
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
KRS	Koronivia Research Station
LRD	Land Resources Division
MAF	Ministry of Agriculture and Fisheries, Samoa
MTA	Material Transfer Agreement
MOA	Ministry of Agriculture, Fiji
ORT	On-line reporting tool
PGR	Plant Genetic Resources
PGRFA	Plant Genetic Resources for Food and Agriculture
PTSC	Pacific Tree Seed Centre
QMS	Quality Management System
SPC	Pacific Community
TOR	Terms of Reference
USP	University of the South Pacific

### Annexes

#### The Terms of Reference (TOR) for the Genebank Review Panel

The Global Crop Diversity Trust commissions periodic reviews of genebanks supported by its endowment through long-term grant agreements. These review aim to assess the

efficiency and effectiveness of the genebank's operation as a whole, the status of conservation for the supported collections, and the status of the genebank within the context of the host institution as well as global system for the conservation and use of the crops concerned.

The specific objectives of the proposed review of SPC's Centre for Pacific Crops and Trees (CePaCT) are to:

- Assess the effectiveness and efficiency of the management, operations, facilities, and activities of the CePaCT genebank.
- Assess the roles, services and use of the CePaCT genebank, and the linkages with users and other partners.
- Review the status of the CePaCT genebank with respect to performance targets and the feasibility of proposed work plans to reach targets.
- Consider the status of individual collections maintained by the CePaCT genebank in the context of a global system for long-term conservation and use of the crops in question.
- Provide actionable recommendations and pathways for the strengthening of the CePaCT genebank's operations within Fiji and its linkages to member countries in the Pacific, based on perceived country needs.

The review will be facilitated by a Crop Trust member of staff, who will provide background information, coordinate the development of the agenda, manage any user or partner survey, and coordinate the execution of the review on site. The Crop Trust facilitator will participate in all review sessions unless requested not to, assist in any aspects of the review, and the completion of the final report. However, the Crop Trust will not take part directly in the formulation of the review report and recommendations.

The review will be undertaken in three phases:

General background and literature review: Reviewer(s) will be provided with the following documents:

- Long-term grant agreement(s)
- Baseline data from ORT
- Annual technical reports and workplans
- CePaCT self-assessment of past and current performance
- CePaCT manuals, website and related materials
- Any relevant strategic planning documents for CePaCT and SPC
- Relevant past reviews of CePaCT and SPC
- The past 5- year budget or expenditures for CePaCT, including sources of funds in addition to the Crop Trust long-term grant
- Any other materials needed by the review panel as background

All review panel member(s) and the CePaCT manager will be involved in the development of the agenda for the site visit. This is an important process during which specific issues and questions are identified for review and relevant stakeholders and users within and outside SPC are identified for consultation.

At least one interaction will take place in advance of the site visit, between the panel member(s) and Crop Trust staff, either through a visit to the Crop Trust HQ or by conference call.

Site visit: The review panel member(s) will conduct site visits of the CePaCT genebank following the agreed agenda. The site visits will involve interactions between the panel members and relevant SPC senior management, researchers and breeders, as well as the full CePaCT staff. Three sites have been chosen for visit by the panel member(s): (1)

CePaCT, Fiji; (2) Vanuatu Agricultural Research and Technical Centre (VARTC), Vanuatu; and, (3) Koronivia Research Station (KRS), Ministry of Agriculture, Fiji. The review panel member(s) will determine the scale of these interactions in the development of the agenda.

Given that discussions during the review are usually intensive, panel members may wish to review together the findings at the end of each day. There may also be a need to make adjustments to the agenda in order to pursue certain issues in greater detail. The draft recommendations will be presented to CePaCT staff and SPC management on the last day of the site visit.

Completing the report and presenting the recommendations: The review panel will produce a report of no less than 5,000 words in which actionable recommendations are clearly stated and justified. The report should be submitted to the Crop Trust for initial review to ensure that the recommendations are clear and actionable. The Crop Trust will solicit a response from SPC, and also provide its own response to the recommendations. In the event of a lack of endorsement by SPC or the Crop Trust to a recommendation, further discussions may be undertaken between the Crop Trust, review panel members and SPC staff.

The Crop Trust Executive Board will review the completed report. The report will also be made available on the Crop Trust website, circulated to other Crop Trust long-term grant recipients, such as the CGIAR genebank managers, and presented at the next Annual Genebanks Meeting.

The specific responsibilities of the Review Panel Member(s) are to:

- Review background documents and data
- Develop the sites visit agenda
- Conduct any background research or informal consultation concerning the review crops or institute in preparation for the site visit
- Participate in discussions with Crop Trust staff to form an understanding of past interactions and experiences between the Crop Trust and CePaCT/SPC, and of future workplans.
- If required, present the aims of the review to CePaCT/SPC staff
- Participate and/or conduct interviews with CePaCT staff and stakeholders
- Prepare a written report, including actionable recommendations
- If required, present the findings and recommendations of the review in subsequent relevant meetings.

### **The Background Documents Provided to the Reviewers**

Article 15 agreement of SPC with the ITPGRFA

SPC and Crop Trust Long-term grant agreement

Baseline data from ORT from 2012

Annual technical reports and workplans 2013-2015

CePaCT manuals, website and related materials

The past 5- year budget or expenditures for CePaCT, including sources of funds in addition to the Crop Trust long-term grant

McGregor, A. with Peter Kaoh, Laisene Tuioti Mariner, Padma Narsey Lal and Mary Taylor (2011). 'Assessing the social and economic value of germplasm and crop improvement as a climate change adaptation strategy: Samoa and Vanuatu case studies'. A background case study prepared for IUCN's report, Lal, P. N. (2011) Climate Change Adaptation in the Pacific: Making Informed Choices, prepared for the

Australian Department of Climate Change and Energy Efficiency (DCCEE), IUCN, Suva, Fiji, xvii + 35.

Grahame Jackson & Peter Walto. 2017 **Pacific Agriculture Policy Project** The fate of CePaCT germplasm in the Pacific islands, 2009-2015

Strengthening crop conservation post cyclone Winston Technical and Financial Progress Report: Number 1

End of service report Mary Taylor, Genetic Resources Coordinator and CePaCT Manager May 2012

Genetic resources coordinator report Period: 6 August 2001 (Curator) – 31 January 2017 (Genetic Resources Coordinator) By Valerie Saena Tuia Report on Status of Information Management at the Centre for Pacific Crops and Trees (CePaCT) SPC, Fiji

Report on capacity building. March, 2015 Michael Mackay, PhD, Consultant

Report on Status of Information Management at CePaCT-SPC, Fiji. Michael Mackay. Consultant Report, March 2015

Benefit-sharing Fund of the International Treaty on Plant Genetic Resources for Food and Agriculture Project Cycle 2010-2011 WINDOW 2 IMMEDIATE IMPACT PROJECTS PR-83-FIJI Final Technical Report

Intra-ACP Agriculture Policy Program Pacific Crop Staples *A Food Secure Response to Climate Change* A Review of Distribution and Evaluation Data from SPC Plant CePaCT (Desk Study) Grahame Jackson and Peter Walton

ROM Reports Projects and Programmes Project title Adapting clonally propagated crops to climatic and commercial changes. Project reference C-230267 Delegation in charge Fiji Status Draft Report date 02/05/2017

Pacific Agricultural Plant Genetic Resources Network (PAPGREN) & Pacific Breeders Network Meetings Suva, Fiji 1st – 5th December 2014

Independent External Review of the Secretariat of the Pacific June 2012

Adapting clonally propagated crops to climatic and commercial changes. Final Report INEA: The International Network for edible Aroids.

Various annual reports from INEA

### The Programme of the Site Visits in Suva and Apia

31<sup>st</sup> July – 4<sup>th</sup> August 2017

Date	Time	Activities	Personnel Involved
July 31 Monday	8.30 – 10.30 am	<ul style="list-style-type: none"> <li>• Introductory meeting and presentations between the Review Team and SPC LRD relevant staff members:                             <ul style="list-style-type: none"> <li>✓ Introductions</li> <li>✓ Presentation by Reviewers on overall purpose and objectives of the review as well as plans for the next 2 days</li> <li>✓ Presentation by LRD on description of the overall institutional strategy for SPC in the region and where the genebank fits into on-going or planned needs and activities.</li> <li>✓ Q &amp; A</li> </ul> </li> </ul>	<p><b>Review Team</b></p> <p>Crop Trust representative</p> <p><b>SPC LRD:</b></p> <p>Jan Helsen, Siosuia Halavatau, Dean Solofa, Logotonu</p>

## Review of CePaCT's Long Term Collections

			Waqainabete, Ulamila Lutu, Israela Abrahamson, Azaria Lesa, Gibson Susumu.
	<b>10.30 - 11.00 am</b>	<b>Morning Tea</b>	
	11.00 – 1.00 pm	<ul style="list-style-type: none"> <li>Review Team visit to CePaCT genebank and field collections.</li> <li>Tour of facilities &amp; field collections in SPC CePaCT</li> <li>Meeting with genebank staff</li> <li>Presentations on CePaCT genebank overall functions, systems of operations currently in use, status of CePaCT collections, acquisitions, distributions, virus indexing and research</li> <li>Q &amp; A</li> </ul>	<b>Review Team</b> <b>CePaCT Staff</b>
	<b>1.00 – 2.00 pm</b>	<b>Lunch</b>	
	2.00– 4.30 pm	<ul style="list-style-type: none"> <li>Focused discussions with all CePaCT staff on areas such as Staff work plans, monitoring and evaluation; data/documentation management, germplasm health, distribution updates and issues, risk management, finance administration, back up collections (seeds storage, cryopreservation, in situ conservation links, crop focus for conservation, capacity development issues, increasing efficiency of genebank</li> </ul>	<b>Review Team</b> Crop Trust representative  <b>CePaCT Staff</b>
<b>Date</b>	<b>Time</b>	<b>Activities</b>	<b>Personnel Involved</b>
August 1 Tuesday	8.30 – 10.30 am	<ul style="list-style-type: none"> <li>Continue and round up focussed discussions with CePaCT staffs</li> <li>View database and documentation systems</li> </ul>	<b>Review Team</b> <b>CePaCT Staff</b>
	<b>10.30- 11.00 am</b>	<b>Morning Tea</b>	<b>CePaCT</b>
	11.00 – 1.00 pm	<ul style="list-style-type: none"> <li>Visit to the Pacific Tree Seed Centre (PTSC)</li> <li>Presentation on role and operations of PTSC</li> <li>Q &amp; A</li> </ul>	<b>Review Team:</b>  <b>SPC staff:</b> Elina Young
	<b>1.00 – 2.00 pm</b>	<b>Lunch</b>	
	2.00 – 4.30 pm	<ul style="list-style-type: none"> <li>Visit to the Ministry of Agriculture, Fiji Tissue Culture Lab and Field collections in the Koronivia Research Station, Suva.</li> <li>Visit to be led by Mr.. Savenaca Cuquma (Principal Agriculture Officer, Research) with MOA, Fiji.</li> <li>Q&amp;A</li> </ul>	<b>Review Team:</b> Crop Trust representative  <b>SPC staff:</b> Logotonu Waqainabete, Ulamila Lutu  <b>MOA staff:</b> Savenaca Cuquma,

## Review of CePaCT's Long Term Collections

<b>Date</b>	<b>Time</b>	<b>Activities</b>	<b>Personnel Involved</b>
August 2 Wednesday	8.30 – 10.30am	<ul style="list-style-type: none"> <li>• Opportunity to meet or discuss any other issue of importance with SPC relevant staffs that may have been missed in the last couple of days.</li> <li>• Reviewers sum up findings and develop draft recommendations of review</li> </ul>	
	<b>10.30-11.00am</b>	<b>Morning Tea</b>	
	11.00 – 1.00pm	<ul style="list-style-type: none"> <li>• Reviewers presentation of review findings and draft recommendations to SPC LRD senior management</li> </ul>	
	1.00pm – 2.00pm	Lunch	
	2.00pm – 4.30pm	<ul style="list-style-type: none"> <li>• Reviewers courtesy call to SPC Deputy Director General Suva</li> </ul>	
<b>Date</b>	<b>Time</b>	<b>Activities</b>	<b>Personnel Involved</b>
August 3 Thursday		<ul style="list-style-type: none"> <li>• Reviewers leave for site visit (Samoa)</li> </ul>	
	<b>10.30-11.00am</b>	<b>Morning Tea</b>	
		<ul style="list-style-type: none"> <li>• Visit to Mr. Tilafono David Hunter, CEO Ministry of Agriculture and Fisheries (MAF) of Samoa and Mr. Moafanua Tolo, acting CEO Crop Division MAF</li> <li>• Visit to field station of MAF at Nu'u to see the new Tissue lab building and evaluation trials of Taro</li> </ul>	
	1.00pm – 2.00pm	Lunch	
		<ul style="list-style-type: none"> <li>• Drafting of report</li> </ul>	
<b>Date</b>	<b>Time</b>	<b>Activities</b>	<b>Personnel Involved</b>
August 4 Friday		<ul style="list-style-type: none"> <li>• Visit to The University of the South Pacific (USP), meet with the Head of the School of Agriculture and Food Technology, Associate Professor Mohammed Umar,</li> <li>• Visit to the Tissue Culture Unit at USP, and meet with Dr Elena Martin Avila visiting scientist at the Crop Division MAF</li> </ul>	
	<b>10.30-11.00am</b>	<b>Morning Tea</b>	

		<ul style="list-style-type: none"> <li>Drafting of report</li> </ul>	
	1.00pm – 2.00pm	Lunch	
		<ul style="list-style-type: none"> <li>Drafting of Report</li> </ul>	

The Ministry of Agriculture and Fisheries (MAF), Crops Division, is rebuilding its Tissue Culture (TC) laboratory and upgrading its operational standards to those of an international standing. At this time MAF Crops Division are using the University of the South Pacific (USP) laboratory to conserve their TC collection as well as the CePaCT back up collection. The renewal of the TC Lab is being funded by the Samoan Agriculture Competitive and Enhancement Project (SACEP), under the umbrella of the World Bank. Completion of the work is expected by Oct-Nov 2017. The main purpose of the lab is to act as a backup facility for conservation of *in vitro* plant genetic resources of agricultural importance to the South Pacific. The idea is that the facility could accommodate plant material from SPC TC Lab and others facilities and store as *in vitro* backup cultures. They also aim to provide disease-free planting material to farmers in the region, whose agriculture is highly vulnerable to diseases, pests and climate change. In addition they expect to use the facility as a training and research facility for the South Pacific.

The new established TC Lab will be noticeable bigger than the older facility. There will be three growth rooms: one designated as a conservation growth room, a second room assigned as a multiplication growth room and the third room is allocated for the bioreactor and as a research growth room. The other parts of the building, including media preparation and subculture areas, have been designed to comply with safety and aseptic standards in order to minimize contamination within the building.

#### The Capacity to undertake Cryopreservation at SPC CePaCT

In the framework of the Crop Trust funded project “Development and refinement of cryopreservation protocols for the long-term conservation of vegetatively propagated crops” (2008 to 2011), KU Leuven and Bioversity International worked on optimizing/developing protocols for all edible aroids. This included taro (*Colocasia esculenta* (L.) Schott), giant taro (*Alocasia macrorrhizos*), swamp taro (*Cyrtosperma merkusii*), and arrowleaf elephant's ear (*Xanthosoma sagittifolium*). Of the 13 accessions of edible aroids samples received from SPC, and after optimisation, the protocols for *Alocasia* and *Xanthosoma* gave 50-100% and 50-70% respectively for post thaw regeneration frequencies. With respect to swamp taro (*Cyrtosperma*) a cryopreservation protocol was developed that resulted in 20-40 % regeneration but regeneration conditions need to be further optimised