

NEWS

Tom Heller

Tom took up the role of Seed Collection Officer for the MSBP at the end of September 2007, and in this time has been on collecting and training expeditions to Tanzania, Ascension and the Falkland Islands, as well as undertaking some collecting in England. Based in RBG Kew's Herbarium, he also contributes to the identification of MSB herbarium vouchers. Tom began work with the MSBP in 2004 as Botanical Information Researcher with the MSB Enhancement Team, compiling information on target species from the literature for the MSB's Seed Collection Guides, and providing training in the use of BRAHMS databases. Prior to this, he studied for an MSc in the Biodiversity and Taxonomy of Plants at RBG Edinburgh.

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Obituary – Tlhalaganyo Ounce Ofentse



It is with great sadness that I have to report the untimely passing of our friend and colleague **Tlhalaganyo Ounce Ofentse**, Research Officer and an active participant in the Millennium Seed Bank programme in Botswana. I have personally known and worked with Ofentse since 2004, through the MSB activities he coordinated at the Department of Agricultural Research, Botswana. His was one of our key collaborators and a true champion for the MSB project in his country. His passion for plants and his infectious attitude to life will remain with all of us who were fortunate enough to work with him. During the last 12 months Ofentse had been on sick leave, seeking medical attention in Gaborone. Sadly, he was diagnosed with a stomach cyst and Ofentse died on Sunday the 6th of April 2008 at the age of 35. He was about to start a PhD study this year in Sweden. Friends, and particularly we colleagues in the MSB project, have lost a valuable member of our seed conservation network. I hope we can all pick up where Ofentse left, and fill up the gap. May his soul rest in peace.

Moctar Sacande



A message from Paul Smith

Over the past 18 months we have been working to develop Kew's Breathing Planet Programme, a strategic plan for a greener world. Seed banking is at the very heart of this strategy. It is our intention to extend the Millennium Seed Bank's global partnership programmes to secure 25% of the world's plants in safe storage by 2020, and to establish a global network of scientists and practitioners working in restoration ecology, to use seed banks for the urgent repair and re-establishment of damaged native vegetation. Using these and other elements of the strategy as our guide (see Kew's Corporate Plan for details www.kew.org/aboutus/cp2007.html) we have been working on the

development of a framework for the next phase of the Millennium Seed Bank Project, to run from 2010 to 2020. Over the next few months, we will be discussing this framework with you and asking for your vision and practical suggestions on how you think our partnership should evolve. This is a period of intense activity. Clearly we need to demonstrate the success of the current project by bringing it in, on time and on budget. At the same time we need to develop a compelling and ambitious vision for the future that will attract the funding we need. We hope that you will continue to travel with us on this journey.

Workshop on Seed Conservation for Ecological Restoration in Cuba

A Workshop on Seed Conservation for Ecological Restoration was held in Santa Clara, Cuba, on 19th April 2007, during the 2nd International Symposium on Ecological Restoration. The workshop was organized by the National Organization for the Protection of Flora and Fauna (Empresa Nacional Para La Protección De La Flora Y La Fauna) and the Cuban Group for Restoration Ecology (Grupo Cubano De Restauración Ecológica), in collaboration with the Seed Conservation Department (SCD) of the Royal Botanic Gardens (RBG), Kew.

The goal of this one-day workshop was to bring together researchers and practitioners from the fields of seed conservation and ecological restoration, with the aims of: (i) reviewing the theory, technology and practical aspects of seed conservation; (ii) discussing the challenges associated with seed conservation and regeneration for ecological restoration; and (iii) considering ways to create effective systems for seed supply to alleviate pressure on *in situ* populations.

The workshop was coordinated by Dr. Tiziana Ulian, Latin American officer at the SCD of RBG Kew, and Ms Bárbara Muñoz, from the Institute of Ecology and Systematics (Instituto de Ecología y Sistemática) in Cuba, with the assistance of Dr. Adriana Rovere, from the National University of Comahue in Argentina, who facilitated the discussions. Using the Millennium Seed Bank Project as historical case,

participants were introduced to comprehensive seed banking techniques, which have been widely used in the SCD and partners' countries. Prof. Hugh Pritchard, Head of the Research Section at the SCD, explained theoretical aspects of seed conservation and research challenges encountered in tropical seed biology, ecology and conservation. Seven case studies from five countries in Latin America were presented: Argentina (1), Colombia (2), Cuba (1), Mexico (2), and Venezuela (1), covering areas ranging from the selection and sampling of species, populations, and seeds for ecological restoration, to the choice of scientific criteria for seed collecting, conservation and regeneration of species.

The workshop represented a good opportunity for restoration ecologists to learn about the theory and practice of seed conservation and to discuss the associated challenges, especially for seeds of tropical species. The need to increase baseline information on the ecology and biology of tropical seeds, as well as the need to develop predictive models for their conservation and regeneration, has been recognised as urgent.

For more information, please contact:

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Millennium Seed Bank Collection Figures May 2008

	total in MSB	since Phase III started
Collections	41,865	30,429 (1,835 UK)
Species	23,669	19,253 (620 UK)



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The International Newsletter of the Partners of the Millennium Seed Bank Project

www.kew.org/msbp/samara

MSBP making a difference in communities

1) Burkina Faso: Promoting utilitarian herbaceous species in the Sahel

In the Sahel regions of northern Burkina Faso, many herbaceous species lack significant natural regeneration, due mainly to the early heavy grazing by animals. These plants are less likely to set seeds and only remaining rhizomes continuously regenerate. Since 2005, the promotion of utilitarian herbaceous species has become an important subsidiary MSBP activity in Burkina. The Centre National de Semences Forestières (CNSF) has investigated (through the MSBP activities) the possibility of propagating a number of herbaceous species. These species were selected by farmers in the regions and were gathered by the MSBP Burkina collecting team. The activities were planned in the middle of the rainy season and involved both sowing directly seeds and also collecting and transplanting stems/seedlings. These seedlings were then planted in different sites.

Most of the seedlings of the six outstanding species, including *Andropogon ascindis*, *A. gayanus*, *Cymbopogon giganteus*, *Mimosa camporum*, *Panicum phragmitoides* and *Pennisetum pedicellatum*, were well established and survived the long dry season. The combined results on the same sites speeded up the regeneration and degraded land biomass coverage. In the last two years, technical support from the MSBP has enabled collection and provision of about 100 kg of seeds of these utilitarian herbaceous species, to farm communities in the Central, Northern and Sahel regions of Burkina Faso. Seeds for this purpose are sponsored seeds by CNSF.

Representatives of farmer groups were trained as trainers in handling seeds and seedlings, and the species source materials were localised within a protected forest, Deux Balés in the Central region, for stem collections. This whole undertaking is making a difference in farmers' communities, meeting their needs and choices, including recovery of degraded lands, restoration/improvement of fallows, and animal feeding. These activities benefit both the improvement of the farming systems and the ecology against desertification, utilising socio-economically and ecologically wild herbaceous species.



Farmers planting stems of *Andropogon ascindis* in lines, along anti-erosive cordons for stability and for the reduction of rain water run-off from cultivated farms. Inset: Established seedlings from direct sowing of *A. ascindis* seeds in a fallow field

PHOTOS: L. SANOU, CNSF

The initiative has been taken up by the Burkina Ministry of Environment who are now promoting and sponsoring it. They have approached the Agricultural Ministry in order to extend such operations that will help biodiversity conservation, recovery of degraded lands and fallows, and increase biomass production for various uses in Burkina Faso.

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Story continues on page 2

'Difficult' seeds project



Following stakeholder workshops in July 2006, Kew staff have developed a two-week practical training programme aimed at improving the identification, handling, storage and use of 'difficult' seeds by crop seed banks. To date, 60 participants from 48 institutes in 38 countries have attended workshops in Kenya, Burkina Faso, Botswana and Morocco.

Funded by DEFRA and supported by FAO, the project hopes to overcome some of the constraints to conserving and using the seeds of some 200 species important to rural livelihoods in Africa. Many of these difficulties can be easily overcome: participants at the recent workshop in Botswana learnt how to overcome physical dormancy in *Corchorus tridens* by chipping the seeds.

Feedback from participants has been extremely positive and all have returned home with an action plan to tackle the 'difficult' seeds in their seed banks.

Left: Participants from Kenya, Rwanda, Ethiopia and Seychelles at the 'Difficult' Seeds Workshop in Kenya

Right: Dr Robin Probert and participants from the Botswana 'Difficult' Seeds Workshop

The project is also facilitating gene banks to engage with farmers, community seed banks and small scale seed producers, with the aim of improving seed storage and seed security.

A 'difficult' seeds website will be developed in 2008 and funding is being sought for follow-up activities.

MSBP making a difference in communities *Continued from page 2*

2) Botswana: Planting useful species in the northwest

One of the important MSBP activities in Botswana is the propagation of useful species at Veld Products Research and Development (VPRD). The first batch of 200 useful plant seedlings was donated during a ceremony on 25 July 2007 at Etsha 9, a village in the northwest of Botswana. The seedlings are used for an afforestation project of communities' woodlots that is supported by the USA ambassador to Botswana and the 'Every River Has Its People Project' in Botswana. VPRD, through the MSBP have been raising seedlings of species including *Hyphaene petersiana*, *Euclea divinorum* and *Berchemia discolor* that were part of the donation. Six of those seedlings were planted at the ceremony, in an exercise led by Ms. Masego Kruger-Gaadingwe, the MSBP Officer at VPRD; the rest will be planted after the first summer rains by the communities of the Etsha villages. For many decades, these communities have been harvesting leaves of the fan palm, *H. petersiana* to support their now flourishing and well known basket weaving industry. The roots and bark of both *E. divinorum*

and *B. discolor* are used to produce different colours to dye the baskets. There is a need today, to support sustainable use through planting, as these useful species are severely over-exploited and depleted.

Contact: Ms. Masego Kruger-Gaadingwe at VPRD (masego2001us@yahoo.com; veldprod@info.bw)



Ms. Masego Kruger-Gaadingwe and Ms. Catherine Canavan, the USA Ambassador to Botswana planting a *Hyphaene petersiana* and some Etosha community members

PHOTO: M. KRUGER_GAADINGWE, VPRD

Orchid Seed: from Lindley to modern biotechnology



Kew botanists' long and distinguished involvement with the orchid family can be traced back to 1865, when Sir William Hooker had the foresight to acquire John Lindley's orchid herbarium with its many type specimens. The Victorian era was the heyday of new orchid discoveries, but already at this time there were early warning signs that key habitats were being destroyed, and desirable species over-collected. In a world where it is projected that, if nothing changes, large numbers of species will become extinct in the next 50 years, conservation is becoming an ever more urgent task. As it becomes apparent that not all orchid habitats are going to be preserved in the near future, the potential value of *ex situ* conservation techniques as a complementary strategy to habitat preservation is becoming increasingly apparent.

Both because orchid embryos are minute, containing a minimum of food reserves, and because of their absolute requirement to form liaisons with suitable fungal partners to germinate in their natural habitats, it was thought that these micro-seeds, in some undefined way, might differ from seeds of other plant families and be impossible to store over the long-term. However, we now know that improved longevity as a result of drying is similar in orchids as in other species, thus potentially they can be stored in seed banks at refrigerator or freezer temperatures for many decades.

Orchid Seed Stores for Sustainable Use (OSSSU) is a Darwin Initiative project, headed by Hugh Pritchard (Project Leader) and Phil Seaton (Project Manager), designed to establish orchid seed banking around the globe using conventional seed banking techniques. With around 25,000 species currently known to science, the orchid family is perhaps the largest and most diverse.



OSSSU aims to collect and store seed from a minimum of 250 species, focusing on orchid hot spots in the Asian and the Central and South American regions, representing the orchid floras of 16 participating countries: China, India, Indonesia, the Philippines, Singapore, Thailand and Vietnam, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Guatemala and Mexico. A number of the target species for OSSSU are present in the Lindley Herbarium, including the beautiful *Guarianthe (Cattleya) skinneri*, both the National Flower of Costa Rica and a flagship for orchid conservation for in Guatemala, where it was first collected.

Regional workshops have been held in Chengdu, China and Quito, Ecuador, in October and November 2007 respectively. More than forty participants reflected a wide range of biotechnology experience in the laboratory, horticulture and natural history, and were provided with opportunities to exchange experience and expertise in seed storage and *in vitro* germination techniques, to develop common protocols and to set annual targets for species stored in each individual country. OSSSU, however, is only the beginning. We would like to recruit more institutions, and to set a much more ambitious target of seeds representing 1000 orchid species in storage by 2015, with from at least 30 countries.

Philip T. Seaton and Hugh W. Pritchard
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The holotype (above) for *Guarianthe (Cattleya) skinneri* (left) is held in the Lindley herbarium.



OSSSU participants at Chengdu



OSSSU participants at Quito Botanical Garden.

A selection of international programme activities

Mexico

In February 2008 FESI-UNAM expanded the Mexico seed collecting programme into the southern part of the Baja California peninsula. Fieldwork has been prioritised using the target guide for the peninsula, described in Samara 13. Following visits to the region by Michael Way and FESI-UNAM personnel, an agreement with biologists at CIBNOR, La Paz, is enabling collector Juan Ismael Calzada to carry out initial preparation of seed and herbarium material at the CIBNOR herbarium. The collections are then sent by courier to FESI-UNAM, where the seed bank team lead by Isela Rodriguez completes the processing of the material. This collecting area is proving to be productive for Ismael, due to the diversity of endemic species and the varied topography. Notable finds include the shrub *Viscainoa geniculata* (Zygophyllaceae), which takes its name from the Vizcaino Desert at the mid-point of the peninsula.

In central Mexico, the CONABIO-funded collector Ulises Guzman continues to make new collections for the project, including several species of Cucurbitaceae. As new collection data has been captured in the Biotica information system and promptly provided to CONABIO, the project has benefited from annually renewed support for the field and laboratory support costs of this programme. The laboratory work has also been strengthened by the purchase of a new germination incubator, which is now in use for routine germination testing by seed bank staff. With this equipment, Isela and her colleague Lilia Garcia, can put into practice the protocols that they learnt during their MSBP technical attachment with INIA Chile, in January 2007.

Extract from Baja California collecting guide compiled by Oswaldo Tellez: *Viscainoa geniculata* specimen from Mexico national herbarium



China

Banking China's Alpine Flora

China's Qinghai-Tibet Plateau, with an average altitude of 4000m, contributes to a quarter of China's territory. Through the effort of climate change and other human activities, China is verge on losing some of its unique plants.

According to the *Flora of Xizang* (Tibet), around 5,252 species are recorded from Xizang. Most of them are endemic and very important to local communities as food, medicine, fuel and for other purposes.

In summer 2007, a joint seed collecting trip was organized by staff from the herbarium of the Kunming Institute of Botany, the Germplasm Bank of Wild Species China (GBWS), the Institute of Tibetan Plateau and RBG Kew's Millennium Seed Bank (MSB) with the aim to conserve the endemic species from the alpine region.



USA

Seeds of Success

Since its beginning in 2001 Seeds of Success (SOS), the U.S. seed collection arm of the Millennium Seed Bank Project, has grown from a handful of collecting teams in the western U.S. to over forty teams nation-wide. Almost 7,000 collections have been made from 2001-2007 contributing over 2400 new species to MSB's global target. The goal of our the national program is to develop commercially available native seed for use in restoration projects.

With pressures like global climate change, invasive species, and increasingly severe wildfire seasons, native plant materials are in need now more than ever. Material collected under the program is used for native plant materials development activities such as; direct reseeding in restoration projects, establishment of germination protocols, and in common garden studies, with portions of each collection held in two long-term storage facilities.



SOS collector from the Desert Botanical Garden collecting seeds for a restoration research project at the Aqua Fria National Monument

There is a critical conservation need in the U.S. to develop native plant materials, as the current market does not supply the diversity or quantity of native plants needed for restoring the American landscape. The U.S. Native Plant Materials Development Program's goals are to, research and develop native plant species, establish ecoregional programs, increase seed storage capacity within Federal agencies, expand SOS collection and curation to 20,000 collections, develop guidelines for seed transfer zones of native species, and to provide cohesive programmatic leadership and infrastructure.

The seeds of 55 species were harvested in the Southeast corner of Xizang, including the endemic species *Kelloggia chinensis*, *Incarvillea delavayi*, *Salvia roborowskii*, *Paraquilegia microphylla*, *Lancea tibetica*. The seeds of these species will be stored in GBWS and MSB. This is GBWS's first batch of seeds collected from Xizang. More integrated activities are conceived with the aid of MSB, for China's alpine flora conservation, and to respond to the latest China Plant Conservation Strategy and National Climate Change Programme.

Left to right: Collecting *Sibiraea angustrata*; *Mecanopsis integrifolia* rooted on the screes; Seeds of *Ephedra* species



Left to right: Identifying key families; Workshop participants; Voucher collecting and pressing



Capacity building in China's nature reserves for plant conservation

In July 2007, the Plant Genetic Resources Conservation Workshop was held in Kunming Institute of Botany (KIB), home of the Germplasm Bank of Wild Species (GBWS) in China, to implement the agreement between KIB and the Forestry Department of Yunnan Province to strengthen the collaboration on plant conservation in Yunnan.

The workshop drew 36 participants from 11 nature reserves together for the two-day training course. The contents included the flora knowledge of Yunnan, plant conservation strategy, seed collecting skill and plant identification. Staff of GBWS passed the skills and knowledge they learned from MSB to the local forestry staff. The workshop also encouraged some nature reserves to join in the seed collecting and conservation network in China, which was initiated by KIB last year. Personnel from GBWS and local nature reserves will work closer to explore and preserve the remarkable plant genetic resources in China.

There are more than 2,000 nature reserves in China which cover about 16% of China's territory. The increased engagement of people from nature reserves and those who are active in *in-situ* conservation, will make a great contribution to the implementation of complementary conservation strategies and to achieve the GSPC targets.

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Mali

The Millennium Seed Bank project's first "francophone" network meeting was held in Sikasso, Mali, from 26th to 30th November 2007. Four RBG Kew staff members joined 15 scientists and technicians from Mali, Burkina Faso and Madagascar to attend the workshop, during which the partners exchanged information on collecting and banking seeds from wild plants. They discussed subjects including databasing, conservation assessments and habitat restoration, and also examined the strengths and weaknesses, as well as the future of the MSB project, in the region. Two new collaborative projects on field guides for the identification of trees of Mali and Burkina Faso resulted from this meeting. The workshop was followed by a two-week long fieldtrip through Mali and Burkina Faso, adding a benefit for partners from different institutions to see and discuss differences in field practices. In two teams, each of six participants, they travelled over a thousand miles each, northwards and southwards, starting along the River Niger in Mali and reuniting in Ouagadougou, Burkina Faso. A record collection of 100 wild species was made, including important and threatened ones in the Sahel, and many from infrequently visited areas. This exciting trip has been memorable for each participant and we are truly delighted that we will be conserving large proportions of these countries' flora by December 2009.

Above: Collecting group discussing specimen pressing technique PHOTO: M. SACANDE



Seeds of Success Collecting Partners are well placed to extend the seed collecting to new areas and to forge links to nurseries and researchers wishing to use native seed.

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Ex situ conservation of the rare and threatened plants of Mauritius

The MSB is currently co-ordinating a Darwin Initiative project called 'Ex situ conservation of the rare and threatened plants of Mauritius'. The project, which runs from July 2006 to June 2009, is a partnership with the Herbarium of the Mauritian Sugar Industry Research Institute, the Ministry of Agro-Industry & Fisheries and the National Threatened Plants Technical Committee. Central to the project is the establishment of a seed bank in country, which will allow the collection and conservation of seeds of the islands' unique and fragile flora. The islands have an endemism rate of 46% and include 105 critically endangered taxa. Eleven of these taxa are reduced to a single known individual plant.

The original vegetation of the island comprise palm savannah, low altitude dry forest and upland wet forest. However, almost all native plant communities are now badly degraded by introduced species and clearance for sugar cane. Deer, pigs and monkeys cause widespread damage to vegetation, but rats and introduced invertebrates also affect regeneration. Alien plants such as Chinese guava and privet have colonised gaps in native communities and have quickly out-competed the native species. Relict plant communities still occur on some offshore islands and on nearby Réunion, and efforts are being made to eradicate or exclude pest species from certain areas.

As part of their in-kind support for the project, the Mauritian government kindly donated a building to house the seed bank at the Native Plant Propagation Centre of the Robinson Road Nursery, Curepipe. Under the supervision of Keith Manger (Laboratory Manager, SCD, RBG Kew), this building was supplied with a range of equipment, allowing the seed bank staff to dry, clean and store their orthodox seeds to international standards. This equipment includes an incubator drier and hygrometer, used to dry and

Above: **Aigrettes, a Mauritian Wildlife Foundation nature reserve.**

Right: ***Tarennia borbonica* – bois de rat, classed as 'Vulnerable'**



measure seed moisture, a stereoscope for examining seeds, an aspirator for seed cleaning, a foil bag sealing machine used to hermetically seal the cleaned and dried seed and two -20°C freezers, allowing the seed samples to be safely stored for many years. Duplicate samples of the seed collections are also stored at the Millennium Seed Bank in the UK for added security.

Two members of staff, funded by the initiative, are responsible for running the facility and organising the collection of seeds from 300 rare and threatened species over the three years of the project. Pushpa Seepaul, the Seed Bank Technician, visited WTMB at Wakehurst Place in July and August 2007, during which period she was trained in seed collection, curation, storage, germination testing, x-ray analysis, herbarium sample mounting and use of the BRAHMS collection management database. This training is now being cascaded to the other staff members involved in the project – Ms. Nabiihah Roomaldawo, the Darwin-funded Seed Bank Assistant, and Mr. Ranjit Seecharan, the government-funded Nurseryman – as well as a number of other government and NGO staff and student volunteers. Training was also carried out in Mauritius during a visit by Stephanie Miles in April, 2007. Eleven key staff from the Mauritian Seed Bank, the National Parks & Conservation Service, the MSIRI Herbarium, the Mauritian Wildlife Foundation and the government Forestry Service attended. The training was both theoretical and practical, and covered all aspects of seed collection and curation.

In the final year of the project it will be increasingly important to seek in-country support for the work that has been carried out to date, in the hope of securing the funding needed to extend the project and ensure the future security of a remarkable flora.

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Left to right: **The Darwin-funded Seed Bank at Robinson Road, Curepipe; The plant propagation facility, Robinson Road**



Australia's unique wild citrus diversity



The International Treaty on Plant Genetic Resources has identified citrus as one of 35 food crops important to humanity for conservation and development of crop diversity (FAO 2005). Citrus germplasm has traditionally been conserved in *ex situ* field collections of botanic gardens and research stations because of its non-orthodox seed storage behaviour. These collections are vulnerable to pests, disease and natural disasters, so complementary long-term storage options are urgently needed. Target 8 of the Global Strategy on Plant Conservation recognizes the importance of the development of new approaches to long-term *ex situ* conservation for recalcitrant (i.e. non-orthodox) seeded species, stating the need for 'additional resources, technology development and transfer, especially for species with recalcitrant seeds' (GSPC 2002). Cryopreservation (storage at ultra low temperatures) has been reported for seeds of cultivated species of citrus, but has not been fully researched or developed for routine use in seedbanks.

Australia has six species of citrus which represent an important source of wild diversity for this economically important genus. Five of these species are found in Queensland and two are listed as rare and threatened *in situ*. The only Australian wild lime not found in Queensland is the *Citrus gracilis* Humpty Doo lime, a newly discovered species found only in the Northern Territory Top End. Australian wild limes have breeding compatibility with commercial cultivars and some species, such as *C. australasica* (finger limes), form part of an increasingly popular 'bushfood' industry.

Cryopreserving seeds of wild finger limes PHOTO: A. BRIGGS

Inset: Rare listed Mount White lime (*Citrus garrawayi*) growing in a citrus breeding research collection of the Queensland Department of Primary Industries. PHOTO: K. HAMILTON

A recent PhD studied *ex situ* conservation options for the Australian wild *Citrus* species, *C. australasica* (finger lime), *C. garrawayi* (Mount White lime, rare listed) and *C. inodora* (Russell River lime, vulnerable listed). Seed biology, micropropagation and cryopreservation were all investigated. Both micropropagation and seed cryopreservation proved successful and these techniques can now be used to conserve and utilise this important genetic diversity. In addition, the climatically distinct and geographically separate distribution of *C. australasica* (SE Queensland), *C. inodora* (NE Queensland) and *C. garrawayi* (Far N Queensland) provided an opportunity to assess the effects of natural distribution on seed germinability at a range of temperatures, thermal transitions in seed oils and cryopreservation. This research was conducted by PhD researcher Kim Hamilton under the supervision of Griffith University (Dr Sarah Ashmore and Prof Rod Drew) and the Millennium Seed Bank (Prof Hugh Pritchard).

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