



samara

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

Seed Dormancy Research in Western Australia

Western Australia possesses an astonishing number of native plant species, with over 8000 in the south-west mediterranean region alone, 80% of which are endemic. Managing and working with such a diversity of species poses many challenges, not the least of which is seed propagation. Currently around 30-40% of Western Australian species remain difficult to propagate from seed for a variety of reasons, including low seed set, poor seed quality, and intractable seed dormancy. Innovative work by the Botanic Gardens and Parks Authority (Kings Park and Botanic Garden) over the last 10 years has made significant inroads into developing techniques for dormancy alleviation of Australian species.

The use of smoke as a dormancy release agent or germination stimulator has aided in the germination of over 400 taxonomically diverse species and has perhaps been the single greatest breakthrough in seed propagation of native Australian plants. More recently, thermic pulse techniques (exposing seeds to temperatures up to 120°C for short periods of time) have been applied to develop germination methods for some

geosporous species, particularly those of Haemodoraceae (kangaroo paws and related species) and Poaceae (native grass species).

However, despite many years of research and some significant breakthroughs, there is a large group of species, known to germinate readily in the field after fire, that cannot be germinated *ex situ*. This disparate group of "deeply dormant" species is comprised of many taxa that form dominant components of the understorey of many different vegetation communities. These taxa include *Persoonia* spp. (drupaceous Proteaceae spp. commonly referred to as snottygobbles), *Hibbertia* spp. (of the Dilleniaceae, commonly known as guinea flowers or native buttercups), and numerous species of Ericaceae (formerly known as the Epacridaceae or southern heaths), Restionaceae (rushes) and Cyperaceae (sedges). Other problem species include *Boronia* spp. (Rutaceae), *Eremophila* spp.



Top: *Hibbertia subvaginata*

Left to right: *Persoonia saccata*, *Calectasia narragara*, *Leucopogon parviflorus*

(commonly referred to as emu or poverty bushes) and *Calectasia*, *Lomandra* and *Acanthocarpus* spp. (Dasypogonaceae). Many of these taxa are not only vitally important for bushland restoration and rehabilitation programmes but also have significant horticultural potential as cut flowers or garden plants.

Story continues on page 3

Seed collection highlights from Kenya:

A new species and some unique collections made.



Left: **Dry thornbush vegetation** PHOTO: J. DICKIE

year to the "type" locality by Dr. Muasya failed to refine the plant probably due to the excessive grazing that was evident on this fertile area. Material is to be grown on in Nairobi to assist the taxonomic description and this species will no doubt find its way onto the list of threatened plant species for the country.

Other notable collections include:

***Diospyros wajirensis* F. White (Ebenaceae).**

A shrub restricted to an area around the North East town of Wajir

***Hibiscus mastersiana* Hiern (Malvaceae).**

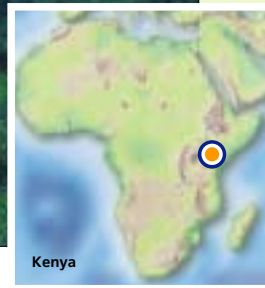
Only the 4th Kenyan collection of this herb

***Porphyrostemma grantii* Bak.**

(Asteraceae). The seed voucher cited in Flora of Tropical East Africa

***Kalanchoe boranae* Raadt**

(Crassulaceae). The third collection of this rare succulent, only known from one population close to the Ethiopian border, not collected for over 30 years



***Krauseola gillettii* Turrill (Caryophyllaceae).** A small hirsute annual plant, known from only a few localities in the northernmost part of Kenya

As the first three-year phase of the Seeds for Life project in Kenya draws to a close, our collecting teams have had some time to reflect on the collection successes and plan how we are to move into a more targeted approach to our programme.

We set ourselves a target of making quality conservation collections of 800 indigenous species which we predicted would translate to at least 500 species new to the collections in the MSB. Whilst the extreme North East of the country remains "out of bounds" on the basis of security, we have travelled the length and breadth of our country. For many of us this included completely new, uncharted territory!

Over the three years we have made 1200 collections which translates to secure, long term conservation collections from more than 750 species. With one season's worth of collections still being processed we are confident of reaching our initial targets.

All these collections represent new material for the National Genebank of Kenya and a significant contribution to the conservation priorities of Kenya and the MSBP. It has provided many challenges for the collection and handling of this new material but it is clear to all that the capacity for us as a country to manage this *ex situ* material has been radically improved.

This phase of our work has been focusing on strengthening the capacity of our seed collectors through training and provision of equipment. Our three teams come from three different Government agencies and this has required developing strong working relationships and protocols. The targeting of our collecting programme has been difficult owing to a lack of quality locality data; access to electronic specimen data from the East African Herbarium is still patchy. Consequently, our collections have frequently been site based and "opportunistic". However, having now databased over 11,000 specimens from priority species with more data to be generated from the Kew collections, our collection programming can now increase target collections from species of high conservation and utility priority.

Despite this lack of information we have had some outstanding achievements: Early in 2002, during a visit to the remote, seasonally flooded Endau plains in the Eastern District of Mwingi, a seed collection from a *Cyperus* was made. Peculiar in its smooth seed coats (rather than rough as in most other Kenyan taxa), it was clearly a new species and is currently being described by Dr. A Muasya from the East African Herbarium. A return visit this

As we look back at our successes, we are looking forward to improving our targeting over the next six years and demonstrating how improved seed collection capacity can play its role in reaching both global and local conservation targets.

For more information contact:

Patrick Muthoka
plants@africaonline.co.ke

During September 2003, RBG Kew's Fiona Hay, spent a couple of weeks in Kenya with Patrick Muthoka, from Kenyan Seeds for Life partner (National Museums of Kenya). As well as visiting the other MSBP partners and looking round the facilities, some fieldwork was carried out. An important part of the visit was meeting with Professor Nyabundi from the University of Maseno where Patrick is being registered for a PhD programme.

Patrick's research work is focused on the longevity of seeds from a range of native Kenyan succulent species – in particular *Euphorbia* species. This genus has a number of economically important species and includes both tree and herbaceous species.

During Fiona's trip collections were made of *E. candelabrum* and *E. gossypina*. Patrick has already assessed the germination requirements and viability of these and some other collections that had been made prior to Fiona's visit and is preparing for the comparative longevity experiments. Good populations of *E. bussei*, *E. gossypina*, *E. graciliramea*, *E. heterochroma*, *E. mangicapsula*, *E. pseudoburuana*, and *E. uhligiana* were also identified for collecting in January/February.

Forest Seed Research in Mali



The Programme Ressources Forestières (PRF, *Forest Resources Programme*) of the Institut d'Economie Rurale (IER, *Institute of Rural Economy*), is responsible for Malian forestry research. The programme is based at Sikasso, southern Mali, in the forest region. It develops research activities related to forest seed handling and storage, the biology of local plant species, the management of forests and trees in rural areas, the implementation of agroforestry systems and soil and water conservation. Seed collection, conservation, and plant propagation play a major role in the programme. The seed research includes studies on optimum periods for seed harvest, optimum storage conditions at ambient temperature and nursery techniques. Seed pre-treatment techniques have been investigated for about 15 indigenous savanna species.

Recently, the seed research activities at IER have been boosted by the technical collaboration and financial support of the Royal Botanic Gardens, Kew, through the MSBP. An official agreement with RBG Kew for transfer of plant materials and equitable sharing of benefits was signed in February 2003. The programme seeks to develop long-term *ex situ* conservation of Malian plant genetic resources, and will strengthen the collaboration with our long-standing partners, such as the Centre National de Semences Forestières (CNSF, *National Forest Seed Centre*) of Burkina Faso. In addition IER is participating in the 3 year, Darwin Initiative/MSBP/IPGRI supported, project for research on community tree seeds of Africa (see Samara, Issue 5, page 3).

This Darwin Initiative Research Exercise on Community Tree Seed (DIRECTS) project seeks to develop conservation research on about 82 local forest species selected for their value and use by people (medicinal, forage, nutrition, non-timber forest product (NTFP) and timber). The PRF is contributing to investigations on studies on fruit development and maturation, and the germination and long-term storage of seeds of 10



Above: Sidi Sanogo (IER-Mali) and driver Moumouni Zida (CNSF-Burkina Faso) pressing specimens in the Dogon country, Mali. PHOTO: A. MCROBB.

Left: Group photo at the DIRECTS research training workshop held 20-26 August 2003 at CNSF, Ouagadougou, Burkina Faso. Participants were from URF, Benin; CNSF, Burkina Faso; INIDA, Cape Verde; CNRA, Cote d'Ivoire; FORIG, Ghana; IER/CRRA, Mali; INRAN, Niger; Awolowo University, Nigeria and DPF, Togo. Drs Moctar Sacande, Hugh W Pritchard (RGB Kew) and Oscar Eyog-Matig (IPGRI) facilitated the workshop. PHOTO: M. SACANDE



priority forest species from Mali. Two Researchers have already participated in the project planning workshop held at the WTMB, Wakehurst Place, UK and in the research training workshop that was held at CNSF, Ouagadougou, Burkina Faso. These workshops help to fill the gaps in our knowledge and consolidate our experiments in the seed laboratory. It is our hope that the new collaboration with the MSBP will strengthen exchanges within an international network and the outcomes of our research activities for the long-term conservation of species.

For more information, please contact:

Sidi SANOGO

Researcher at Programme Ressources Forestières
Centre Régional de Recherche Agronomique de Sikasso
Institut d'Economie Rurale,
BP 16 Sikasso, Mali
Tel: +223 2 620 361
sidi.sanogo@ier.ml or sidi.sanogo@caramail.com

The Centre National de Semences Forestières (CNSF), Ouagadougou, Burkina Faso, has recently launched its web site, making the most of information technology and communication and hoping to raise more interest in the Centre's activities worldwide. Please have a look at: www.CNSF.gov.BF

For more information and feedback contact:
cnsf@fasonet.bf

Seed Dormancy Research in Western Australia *continued from page 1*

Recently, scientists from the Botanic Gardens and Parks Authority (Dr Shane Turner, Dr David Merritt, and Dr Kingsley Dixon), in collaboration with The University of Western Australia (Dr Julie Plummer), began a three year research programme funded by the Australian Research Council which aims to "crack" seed dormancy in many of these key groups required for land restoration and horticulture. Using a combination of different methodologies, including detailed analysis and classification of dormancy types, embryo excision, classification and culture, imbibition studies and new and novel combinations of dormancy alleviation treatments not previously applied to Australian species (including warm stratification and

cycling alternating temperature regimes), it is anticipated that significant inroads will be made into the nature of the mechanisms governing seed dormancy in Australian native plants. Already preliminary results have been highly encouraging and we look forward to presenting some of our research findings in the near future.

For more information, contact

Dr Shane Turner

Botanic Gardens and Parks Authority
sturner@bgpa.wa.gov.au

A selection of international programme activities

Lebanon

In Lebanon, Simon Khairallah has been out in the field for much of the year, collecting seeds for the MSBP, thanks to support from British American Tobacco. Although RBG Kew and the Lebanese Agricultural Research Institute (LARI) have been jointly collecting seeds of wild species since 1996, the relatively large Lebanese flora of around 2,600 species has again allowed Simon to collect a steady stream of species new to the MSBP throughout 2003. Furthermore, during a visit by Kew staff more species new to the MSBP were discovered in the high (2,000 – 2,600 m altitude) ranges of Mount Lebanon as well as further south in the Chouf Mountains. As the season is later at high altitudes only herbarium samples were taken of many of the species on this trip with mature seeds being collected later. At the end of the season in December around 140 collections had been made from what is, in effect, a very limited area in a small country.

During 2003 a deep-freezer, more storage bottles and a digital camera for field registration of species have been bought for the project, adding to the seed counter and set of professional sieves that are already at LARI. While the Lebanese half of the collections is presently held *in trust* at the MSB, the moment is nearing when LARI will be capable of maintaining the collections under equally good conditions – and when the Lebanese half will be repatriated.

Simon Khairallah will visit the Wellcome Trust Millennium Building in the first half of 2004, while his colleague Joelle Breidy will attend the Seed Conservation Techniques course later on.

Clockwise from top:

Arum dioscorides
Onopordum heteracanthum
Moluccella laevis

PHOTOS: A. MCROBB



Madagascar

Stuart Cable, the MSBP's Herbarium Liaison Officer, has been working with Solofo Rakotoarisoa from RBG Kew's Madagascar programme to design a targeted collecting programme for our partner institution in Madagascar, Silo National des Graines Forésières (SNGF). Using data from more than 20,000 herbarium specimens, Solofo and Stuart have produced a Geographical Information System which pinpoints localities and phenologies of some of Madagascar's most threatened succulent species. This GIS based methodology will be tested over the coming months in joint expeditions with SNGF in an effort to increase the number of threatened species collected and conserved under the programme.

Contact s.cable@kew.org

Below: **Madagascan *Pachypodium* sp.**

Below right: **Pitcher plant with *Impatiens* and *Philippia*** PHOTO: P. SMITH



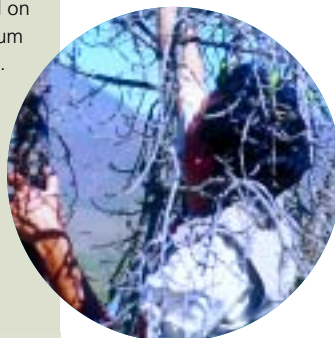
Chile

The second year of the INIA-led project has now concluded and the report is available. Collectors achieved 73 field-days between October 2002 and May 2003 resulting in 137 seed collections (of which 70% are endemic species). CONAF have been invited to take part in the collecting programme in 2004, assisted by a seed collecting technical manual that is due for publication. A new collecting vehicle has been provided for the collecting program. Mario Leon, the project's full time collector has received GIS training and is preparing target lists based on the herbarium specimen data kindly provided by the National Museum of Natural History and the Universities of La Serena and Concepcion.

The Regional Arid Lands Research Center CEAZA (www.ceaza.cl/index_eng.htm) has now been established and funded, providing collaborative research opportunities for RBG Kew and INIA.

In 2004 there will be investment in INIA facilities for the multiplication of small seed collections. A new collections database will be installed and a project web site is also under development to help disseminate advances made by the project.

Right: **Dr. Pedro Leon collecting fruits of *Carica chilensis*.** PHOTO: M. WAY



South Africa

The Annual Report for the MSBP programme in South Africa has just been published for 2002/3, including some impressive collecting statistics. Overall, the collecting programme in South Africa (Pretoria and Kirstenbosch) produced 296 collections. Of these, 175 collections have been named to species level, while 121 are currently unidentified. Of the 175 identified species, 159 (91%) are confirmed target species (endemic, endangered or economic). In addition, 147 are new species for the MSBP. This represents a collections: new species ratio of 1.19, and applying this ratio to the total number of collections, we can expect a total of approximately 250 new species collected during this year.

Details from Erich van Wyk: eww@nbipre.nbi.ac.za

Schizostylis coccinea, belonging to a monotypic genus in the Iridaceae, was collected in the Wakkerstroom area, southern Mpumalanga province.



Australia

Two more Australian states have joined Western Australia as partners in the MSBP.

In September 2003, an Access and Benefit Sharing Agreement was signed with South Australia, represented by the Botanic Gardens and State Herbarium, Adelaide, and the Ministry for Environment and Conservation.

The Botanic Gardens of Adelaide aim to contribute to the conservation of South Australia's threatened flora using *ex situ* methodologies to complement state-wide *in situ* conservation programmes. To achieve this objective, a Seed Conservation Centre has been established at the Gardens with the objective to collect seeds of priority plant species for the establishment of long-term seed conservation collections, and to develop germination and storage protocols for each taxon collected. A six-year collaborative programme to strengthen and expand the existing *ex situ* seed conservation and research programme in South Australia has been developed with the MSBP. Phase 1 (2003-6) will focus on capacity building, staff training, and enhancing the Seed Conservation Centre's ability to collect and manage seed. A second phase will address the development of a dedicated research programme in support of the collection programme and the long-term storage of conservation collections.

In addition, an Access and Benefit Sharing Agreement was signed with the Royal Botanic Gardens, Sydney in New South Wales in November 2003. The MSBP will be working with the New South Wales Seed Bank at Mount Annan Botanic Garden, again with a focus on state-listed threatened species. Like South Australia, a six year programme has been developed, comprising two stages. The collaboration aims to increase the number of collections made, to review the current methods used in the NSW Seed Bank and to adopt improved methods, and to carry out research to strengthen recovery planning for threatened species and ecological communities.

The MSBP is currently negotiating with partners in the remaining Australian States and it is envisaged that a country-wide network of partners will be established during 2004.

Above: **Mount Annan Botanical Gardens, wild flower festival**

Above left: "**Waratah**" *Telopea speciosissima*

Left: "**Flannel flower**" *Actinotus helianthi*

PHOTOS: T. PEARCE

Jordan

As in previous years collecting has concentrated on the roughly 30 % of the land surface of the country that is *not* steppe or desert, the exceptions being the Azraq wetlands in the central part of the country and along the road that ultimately leads to the border with Iraq. As in previous years the collaboration is supported by British American Tobacco. By the end of August 2003 a total of 69 collections have been made in the greener part of the country, with locations from the Syrian border in the north to the Saudi Arabian border in the south visited. The presence of any endemics or otherwise important species will have to wait until identification at the RBG Kew Herbarium is completed.

Training opportunities in late 2003 for the counterparts of the National Center for Agricultural Research and Technology Transfer (NCARTT) have combined with a donation of equipment by the MSBP. In addition, our Jordanian colleagues are in the process of publishing a booklet on Jordanian wild species, both in Arabic and English. Lastly, the joint work on GIS of Jordanian species, which started in September 2002, will be further developed in 2004.

Above: *Achillea wilhelmsia*

Left: *Colutea istria*

Far left: **Fruits of** *Peltaria augustifolia*

PHOTOS: A. MCROBB

Institute for Plant Conservation at the Chicago Botanic Garden

Under the direction of Dr. Kayri Havens, Director of the Institute for Plant Conservation at the Chicago Botanic Garden (CBG), two important projects are wrapping up their first field seasons of successful seed collection.

The first project involves collecting and preserving seed from 1,500 tallgrass prairie species by 2008. In the Midwestern United States, tallgrass prairie is exceedingly rare, with only one tenth of one percent of original habitat remaining. Heather-Lynn Lindon coordinated this effort, and has ended the season with seeds from over 40 species collected from 8 different sites with help from many volunteers. With the groundwork laid, permits in hand, and a group of enthusiastic and trained volunteers, this project is poised to collect seed from over 200 tallgrass prairie species in 2004.

A second project, funded by the Bureau of Land Management, is assessing ecotypic variation and population genetic diversity patterns in common forb species in the Great Basin region of the western



United States. Information gained from this project will be used to aid restoration efforts for habitat disturbed or destroyed by wildfires and invasive species. CBG researchers Jeremie Fant, Lara Jefferson, and Andrea Tietmeyer completed four trips throughout the summer and fall of 2003, collecting seed and leaf material from six study species (*Penstemon* and *Eriogonum*) throughout the Great Basin. RBG Kew researcher Dr. Fiona Hay contributed her energy and expertise to this effort, as RBG Kew will conduct additional germination and longevity studies on collected seeds. This winter at CBG, leaf material is being used in molecular genetic work, and seeds will be grown out to prepare for common garden studies. Work conducted over the next two years will allow researchers to determine the importance of genetics and environment in selecting seed for restoration purposes.

Andrea Tietmeyer

ATietmey@chicagobotanic.org

Top: **Fiona Hay and Andrea Tietmeyer in the field**

Above left: **Wheeler Peak, Nevada**

Above: **Snake Range, Nevada**



Penstemon deustus



Penstemon pachyphyllus



Penstemon rostriflorus in
flower



Penstemon rostriflorus in fruit

Understanding species differences in seed longevity

The seed viability equations developed by researchers at Reading University nearly three decades ago predict that the life expectancy of seeds of different species will vary considerably. Under standard seed bank conditions (~ 3-5% moisture content, -20°C) some seeds such as *Sorghum bicolor* are predicted to survive for over a thousand years whereas others such as *Ranunculus sceleratus* are predicted to live for only a few decades at best.

Physiological approaches to the prediction of seed longevity all use a controlled ageing method. Seed samples are held at a controlled temperature and moisture content and samples are withdrawn at intervals and tested for viability. The most accurate empirical model requires the effects of both temperature and moisture content on viability to be determined. Researcher Fiona Hay and co-workers at the WTMB and MSBP Western Australian partners Kingsley Dixon and David Merritt are using this type of approach to gain a better understanding of the optimum conditions of storage at the species level.

A more streamlined approach, using less time and seeds, that enables reasonable predictions of seed longevity across species, relies on evidence published by Kew scientist John Dickie, of the MSBP, and co-workers in 1990, that the effect of changing temperature on seed longevity does not vary significantly across species. Often nicknamed C_w experiments, this approach involves controlled ageing at a range of moisture levels but at a single temperature. RBG Kew PhD student, Annette Bird, is carrying out C_w experiments in conjunction with biophysical techniques in order to gain a better understanding of why some species are particularly short lived.

Regardless of the approach, the fact remains that relatively few wild plant species have been studied in detail. Whilst the evidence from MSB viability retest analyses are comforting, we simply don't know which species are inherently short- or long-lived. Thus, one of the most important scientific challenges for the MSBP was to gain a better understanding of species to species variation in seed longevity as quickly as possible. In taking seed samples directly from the collections the method had to be economical in

its use of seeds. Also to enable a large number of collections to be studied, the method had to be economical in time and effort.



Above: ***Ranunculus sceleratus***: short lived marker species used in MSB comparative longevity studies PHOTO: A. BIRD



Left: Close-up of samples held inside a sealed container

Below: Hannah Davies placing samples into 45°C incubator for controlled ageing.

At the MSB, Hannah Davies and colleagues have devised a standard ageing protocol that enables comparisons of seed longevity across species using a single carefully controlled ageing environment. The method involves two stages. Firstly, seeds are rehydrated to equilibrium at 47% RH at 20°C and then they are placed into controlled ageing conditions at 60% RH at 45°C. Samples are then withdrawn at intervals and tested for viability. Two marker species for which a detailed viability model is available: *Brassica napus* and *Ranunculus sceleratus* are included from time to time as markers against which species ageing parameters can be compared.

So far more than 90 different species have been examined and placed into a ranking order. The main focus has been to look at species from orders and families that have never been studied before and already species that are both much longer lived and species that are much shorter lived than those already known have been identified.

MSBP partners in Kenya and Australia are also adopting this comparative ageing protocol in an effort to widen our understanding as quickly as possible and so that more informed viability retest intervals for conservation collections can be established.

For more detailed information on the MSB comparative ageing protocol contact **Hannah Davies**: h.davies@kew.org



NEWS

Malawi Collection Guide

Hot on the heels of the seed collection guide for Botswana has come a similar guide for Malawi. This guide was produced by Mala Ram, a BSc student from the University of Bath, UK who has just completed a one year studentship at RBG Kew. Mala based her work on SABONET's Red Data List for Malawi and databased specimens from Kew's herbarium which were either listed as threatened or data-deficient. Using information from the specimens at Kew and from literature sources, Mala was able to reassess the data-deficient taxa, and as a result assigned threatened ratings to the majority of species.

The Malawi collection guide includes species descriptions, phenology, localities, and images of 191 taxa. It is expected that this work will help guide future seed collecting efforts in Malawi.

For more information, contact:

Sharon Balding
s.balding@kew.org

Technology Transfer and the MSBP

Technology Transfer and Co-operation was one of three main themes discussed at the 7th Conference of the Parties to the Convention on Biological Diversity (CBD) in February 2004. Governments considered ways to improve the transfer of technology for conservation and sustainable use of biodiversity, and for sharing the benefits of use of genetic resources.

We have taken this opportunity to assess how the transfer of seed banking technology is being facilitated by the MSBP. A short document has been produced which outlines the technologies used in banking seeds of wild species and how these are transferred between MSBP partners and beyond. We are assessing our progress so far and the lessons that we have learnt. Thank you to those partners that took the time to provide input to the document and make comments on the drafts. The document has been developed into an illustrated brochure, with Spanish and French translations, and was distributed at both the November 2003 meeting of the Subsidiary Body for Technical and Technological advice (SBSTTA) and the conference of the parties in February 2004.

Copies of the document have been mailed to all MSBP partners.

Further copies are available from:

Clare Tenner
+44 1444 894121
c.tenner@kew.org

MSBP at Kew

Neil Brummitt joined the MSBP Herbarium Liaison Team at Kew this September, working with Stuart Cable to identify the seed collecting voucher specimens. Neil has several years of experience working in the Herbarium and is just completing his doctoral thesis on global patterns of plant distribution. With such broad geographical interests, he enjoys identifying specimens from around the world.



As well as naming the voucher specimens, Neil and Stuart assist the international co-ordinators and MSBP partner institutions to set species seed conservation objectives and hope to develop plant identification guides to help our partners target their seed collecting efforts in the field.

For more information, contact:

Neil Brummitt
n.brummit@kew.org

Seed Conservation: turning science into practice

A landmark publication reviewing the current scientific knowledge that underpins seed banking, a technology which plays a key role in the conservation of both domesticated and non-domesticated plant species, is now available. The book is the outcome of a workshop held in 2001 at the MSB.

The book is organised into three sections: Planning and Collecting, Seed Processing and Testing and Seed Storage and Utilisation. Each section comprises a set of reviews, a number of research papers and a series of case studies. The 56 chapters draw on the knowledge and experience of over 100 contributors from 21 countries. As such, the book contains a valuable mix of theoretical and practical information



that will be an essential reference work for those involved in, or embarking upon, a programme of seed conservation. It will also be important reading for those wishing to gain an insight into this technology: scientists in disciplines such as genetics, plant breeding, seed biology, and taxonomy; policy makers; and students.

Published by the Royal Botanic Gardens, Kew, 2003. Edited by Roger D. Smith, John B. Dickie, Simon H. Linington, Hugh W. Pritchard and Robin J. Probert. ISBN 1 84246 052 8.

Copies can be ordered from RBG Kew (www.kewbooks.com).

SID Release 5 – so, what's new?

Release 5 of the Seed Information Database (SID) appeared on Kew's internet site (www.kew.org/data/sid/) in July 2003. A completely new module on seed protein contents has been added, with data for c. 2,400 species, and life-form (*sensu* Raunkier) has been added for over 7,000 species already in the database. Substantial additions have been made to the existing modules on seed weight, storage behaviour, dispersal, germination and seed oil content. Re-ordering of existing data continues, with taxonomy improved by the removal of around 1650 synonyms, especially in conifers, Fagales, and the families Euphorbiaceae and Fabaceae. SID can

now also be accessed via Kew's electronic Plant Information Centre (ePIC). If you would like to search ePIC for other types of plant information, go to www.kew.org/epic/index.htm.

For more information, contact:

Sarah Flynn
s.flynn@kew.org



WE WANT TO HEAR FROM YOU!

Samara is your newsletter, so send us news and articles about yourself and your work.

Contact the editor **Anne Griffin**,
Librarian & Information Officer
Royal Botanic Gardens, Kew
Wakehurst Place, Ardingly, West Sussex, RH17 6TN, UK.

tel: +44 1444 894178 fax: +44 1444 894110 email: a.griffin@kew.org

