



A message from Paul Smith

Many thanks to all of you who have corresponded with us here at the MSB on the subject of future activities.

We have made excellent progress in developing a plan for the next phase that will ensure that the momentum developed by the MSBP is not only maintained but accelerated. Our shared vision for the future is based on three main outcomes:

1. 25% of the world's plant taxa secured in safe storage by 2020.
2. The use of a wide range of plant diversity in critical areas such as habitat restoration and livelihood improvement.
3. Long term financial security is secured for the seeds, data and skills within the MSBP. Given the current global recession, and consistent with achieving long term financial security, a more diverse funding model will be required than in the current phase of the MSBP.

Within the partnership we will be approaching statutory funders, philanthropists, trusts, foundations, corporate sponsors and the general public. Our relationships with these sponsors will vary enormously, some founded on philanthropy and others based on the technical services we provide. This is not only a robust funding model that will enable us to survive financial turbulence, it is also the way in which we will connect with society as a whole.

NEWS

Kenyan PhDs annotated

Congratulations to Dr Desterio Nyamongo and Dr Patrick Muthoka who have both recently been awarded their PhDs.

Dr Nyamongo's thesis was on seed dormancy and comparative longevity in the potential oil crop *Vernonia galamensis* (Cass.) Less. (see article on page 7). Dr Muthoka studied comparative seed longevity for 24 native Kenyan succulent species. Results revealed greater intra-genus differences for species from the *Euphorbia* genus compared with species of *Kalanchoe*. The standard deviation of frequency distribution of seed deaths in time (Σ in the viability equations used to describe seed longevity) varied for some seed-lots collected from different years and / or populations. Dr Muthoka determined the moisture relations of seed longevity for six species of *Euphorbia*. These results will contribute to the better management of seed bank collections of this important genus.

Also successfully completing their PhDs this year were Janice Golding (South Africa), Andrea Mondoni (Italy), Gemma Hoyle (Australia/UK), Jitka Kochanek (Australia) and Simona Birtic

(UK). Information about these and other MSB-supervised PhD students can be found on the project web pages:

www.kew.org/msbp/what/knowledge/Postgradutes.htm

Seed Conservation Techniques training course

The fourth biennial SCT course was held at the MSB from 15th Sept – 4rd Oct 2008, with 11 participants from 9 countries. The course began with a seed 'treasure trail' around Wakehurst Place before beginning the real work discussing and practicing seed handling issues, from collection through to use. Specialist workshops allowed participants to learn more about seed and fruit structure and morphology, data management and conservation biotechnology. A day was spent at Kew, visiting the Herbarium and exploring the gardens.

Questioned on the single most useful thing they had learnt from the course, most participants referred to seed-air moisture relations, post-harvest handling and seed drying methods and how they relate to seed viability and longevity.

2008 IUCN World Conservation Congress

A number of MSBP and Kew staff attended the world's largest and most important conservation event, held in Barcelona, Spain, from 5 – 14 October 2008. Key themes running through the sessions were how climate change and growing energy demands are impacting upon biodiversity conservation and peoples' livelihoods, the importance of diversity for climate change adaptation, the role of agricultural ecosystems in providing food and conserving biodiversity, and the move towards landscape management. Kate Gold and Robin Probert organised and facilitated a half-day learning event on 'Drying and Storing Seeds for the Future' which focused on how small-scale local conservation initiatives can use low-cost techniques for short to medium term seed storage.

For more information about any of the above news items contact **Kate Gold**: k.gold@kew.org



New Publications

Fruit – Edible, Inedible, Incredible
Wolfgang Stuppy & Rob Kessler
Papadakis Publisher, London
ISBN 978-1-901092-74-5

Following their award-winning earlier title "Seeds – Time Capsules of Life", the MSBP's seed morphologist, Wolfgang Stuppy, and artist Rob Kessler have recently produced a new book. In "Fruit – Edible, Inedible, Incredible"

the authors explore the astonishing natural history of fruits, one of nature's most significant "inventions". After a crash-course in carpology explaining the structural reasons for the baffling diversity of fruits, the book embarks on a global journey exploring the various dispersal strategies plants have evolved over millions of years. Particular attention is paid to the co-adaptive evolution between plants and their animal dispersers. Anyone who believed that fleshy fruits were one of nature's most wonderful gifts, simply here to provide us with sweet and healthy treats, will be disillusioned. As it turns out, humans are only part of an elaborate plot that manipulates us and other mammals into becoming unwitting couriers of a plant's most precious asset: its seeds. Like its companion volume "Seeds", this beautifully illustrated new publication captivates its readers with amazing hand-coloured scanning-electron micrographs showing breathtaking structural details of a wide variety of fruits and seeds from all over the world.



Millennium Seed Bank Collection Figures December 2008

	total in MSB	since Phase III started
Collections	44,782	33,356 (1,954 UK)
Species	25,105	20,745 (623 UK)

WE WANT TO HEAR FROM YOU!

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

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

www.kew.org/msbp/samara

Project MGU – The Useful Plants Project

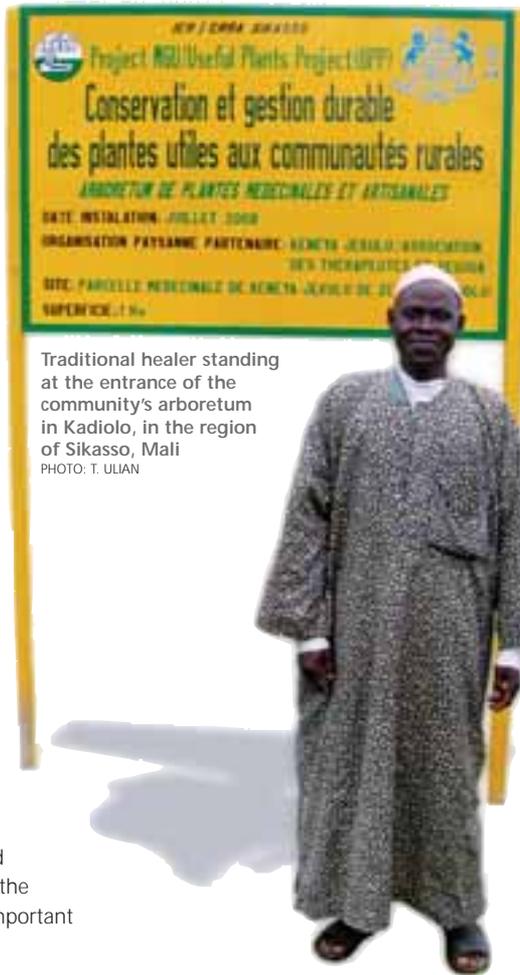
Project MGU - the Useful Plants Project (UPP) – began in June 2007. Focusing on the conservation and sustainable use of useful species, the project is implemented by the Seed Conservation Department together with MSBP partners in Botswana, Kenya, Mali, Mexico and South Africa.

The MGU project aims to enhance the *ex situ* conservation of useful plants for human wellbeing, by building the capacity of local communities to successfully store and propagate useful plant species. The name MGU derives from the Spain-based philanthropist whose generous donation is supporting the project.

The main outputs expected from the project include the identification of targeted useful species; seed collecting and the conservation of these species; plant propagation and support of *in situ* conservation activities.

Useful species are identified and selected through literature review and by carrying out ethnobotanical surveys with communities. Seeds are collected and conserved in the countries' seed banks and duplicated in the MSB.

Applied ethnobotanical, plant physiological, phytochemical and plant genetic studies, carried out by partners in their own countries, support the conservation and sustainable use of the most important useful plants.



Traditional healer standing at the entrance of the community's arboretum in Kadiolo, in the region of Sikasso, Mali
PHOTO: T. ULIAN

The data compiled and produced through the project are entered into databases and the information will be disseminated at different levels through leaflets and/or technical information sheets and research papers.

The capacity of local communities to use a wide range of plant species will be enhanced through training and the improvement of local facilities for plant conservation and propagation.

The project, which will last three and an half years, is progressing particularly well in those countries where there were already well-established relationships with local communities before the start of the project.

For more information, please contact:

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or visit the web page:

<http://www.kew.org/msbp/useful-plants/index.html>

Below from left to right:

Useful plants propagated through the project by the community of Koutiala, in the region of Sikasso, Mali PHOTO: M. SACANDE

Interview with a traditional healer during a workshop in the province of Tharaka, Kenya PHOTO: T. ULIAN

Plant physiology experiments in the greenhouse at FES-Iztacala, at the Universidad Nacional Autónoma de México (National Autonomous University of Mexico) UNAM in Mexico City, February 2008 PHOTO: T. ULIAN



Science underpins the conservation of Western Australia's unique flora

Bob Dixon, Eric Bunn and Luke Sweedman

The Botanic Gardens and Parks Authority (BGPA) not only manages Kings Park and Botanic Garden (KP&BG), but also plays a major role in preserving the biodiversity of the Western Australian flora, complementing the work of the Western Australian Department of Environment and Conservation (DEC). In partnership with the MSBP, BGPA has collected seed from over 700 species. We also have a seed-science team who specialise in research on seed pre-treatments to assist germination and overcome dormancy, and experimentally assess optimal seed storage treatments or requirements.

An integrated multi-disciplinary science team at BGPA, together with other government departments and volunteers, enables us to take a holistic approach to saving rare and endangered Western Australian species. We undertake recovery programs including translocation, and develop methods to propagate, cultivate, and grow on species *in situ*. Projects can involve translocation of rare flora into totally cleared areas (mine sites) or into pristine or degraded ecosystems. The aim is always to establish self-sustaining populations in the long term.

Translocation projects involve researching information on the biology of the species, its propagation, such as seed pre-treatments, seed storage, tissue culture and occasionally cryostorage of vegetative material (or fungal isolates necessary for the culture of terrestrial orchids). For critically endangered species, conserving the existing genetic diversity of the species and managing genetic diversity over time is especially important. The BGPA also has a major ongoing genetic provenance program involving common plants to establish where local provenance seed can be collected for ecological restoration projects.

Depending on the immediacy of extinction threat to a species, and the extent of genetic variation, plants may first be propagated by tissue culture,

or somatic embryogenesis, to create an *ex situ* living collection. Seedlings can then be propagated from seed generated from these plants or directly raised from available seed. In some cases, new plants are generated by seed in culture then bulked up by tissue culture. All plants are raised in the Kings Park accredited nursery to reduce the risk of introducing root pathogens, other diseases, pests and weeds into translocation sites. To protect the species, tissue may also be preserved in cryostorage. Cryogenic storage (i.e. special preparation of tissues using cryo-protectant compounds followed by storage in liquid nitrogen at $-196\text{ }^{\circ}\text{C}$) is a highly cost-effective method of storing living material for long periods of time. Cryogenic research at KP&BG has demonstrated that critically endangered taxa such as the Corrigin Grevillea (*Grevillea scapigera*) can be successfully put through cryogenic storage, shoot tips revived and plants micropropagated and grown on site. These plants have flowered and produced viable seed, and plants raised from these seeds have now flowered and in turn have produced seed.

How well are these translocations performing? Some are already producing natural recruits on site. Many others are producing viable seed which enables us to collect seed for further propagation or to store for long term *ex situ* protection of the species. Several clones of known genetic provenance from a range of rare and endangered herbaceous species, *Anigozanthos terraepectans* and 22 woody species are also in cryostorage (Touchell *et al.*, 2002a and 2002b).

For more information, please contact:
Botanic Gardens and Parks Authority, Kings Park and Botanic Garden,
Fraser Ave., West Perth, Western Australia 6005



Photos clockwise from top left:
Grevillea brachystylis ssp. *australis*, good seedling recruitment after the parent plant died.
Symonanthus bancroftii male plant in full flower, females which produce fewer flowers in the background August 2007. PHOTO: BOB DIXON
Grevillea brachystylis ssp. *australis* translocated to an old mine site. This site was previously covered in an 18 m high clay stockpile.

Case study

Bancroft's *Symonanthus*, *Symonanthus bancroftii* (Solanaceae), is one of the world's rarest plants, with only one wild male plant surviving at present. A second, female, plant was discovered in 1998, but died in 2000. A recovery program has been helping to save this critically endangered plant from extinction since 2002. Material from the two wild plants was used to produce many plants by tissue culture at Kings Park. These were hand-pollinated to produce a single viable offspring – a daughter. The first translocation of 800 young plants, propagated from these three genotypes, was planted into two field sites. Despite various problems, plants started to produce seed in 2005. Seed scientists verified the viability of seed (95% for fresh, and 82% for 1-year old seed) and identified seed pre-treatments to increase seed germination rates, which were very low (4%) for untreated seed.

Several thousand seed were collected in spring 2007 from both the mother and daughter plants. The daughter plants have been shown to produce more seed, on average, than mother plants. This is an interesting outcome and requires further research, as all pollen emanates from a single male genotype.

Last autumn the first seedlings were planted out on site. We are hoping the seedlings, with their vigorous root system, will have much higher survival rates than micropropagated plants. It is also much cheaper and easier to produce plants using this method. One possible drawback with growing from seed is that the ratio of male to female plants from seedlings is unknown until plants have flowered, in contrast to the known ratios when using clonally (i.e. *in vitro*) propagated plants. A good seed production this year will enable further seed collection for propagation and seed storage for long term security and survival of this species.



Symonanthus bancroftii female plant with seed sleeves to collect a small amount of seed whilst the rest will be added to the soil seedbank August 2007. PHOTO: BOB DIXON

References

- Touchell, D.H., Turner, S.R., Bunn, E. and Dixon, K.W. (2002a) Cryostorage of somatic tissues of Australian endangered plants. In: Towill, L.E. and Bajaj, Y.P.S. (eds.) *Biotechnology in Agriculture and Forestry* 50 pp 357-372 Cryopreservation of Plant Germplasm II. Springer, Berlin.
- Touchell, D.H., Turner, S.R., Bunn, E. and Dixon, K.W. (2002b). Cryopreservation of Australian Species – The role of Plant Growth Regulators. In: Towill, L.E. and Bajaj, Y.P.S. (eds.). *Biotechnology in Agriculture and Forestry*, 50 pp 373-390, Cryopreservation of Plant Germplasm II. Springer, Berlin.



Collecting Spinifex (*Triodia schinzii*) along the Connie Sue Highway, South East Desert Region W.A.

PHOTO: BGPAA

A selection of international programme activities

Australia

Botanic Gardens of Adelaide meet conservation milestone – Port Lincoln speedwell (*Veronica parnkalliana*)

A recent seed collection from the Port Lincoln speedwell (*Veronica parnkalliana*) has seen an international collaborative conservation project between the Botanic Gardens of Adelaide and MSBP pass its target milestone of collecting and storing seed from over 1,000 of South Australia's native plant species.

The Port Lincoln speedwell is a small erect herb that grows up to 40 cm in height. It produces small pale blue to white flowers with four petals during early spring, and occurs in sclerophyll forest or rocky sites under mallee vegetation. This little plant is considered endangered in its natural environment, and is found only in South Australia.

Originally discovered near Port Lincoln (South Australia) in 1909, the Port Lincoln speedwell was thought to be extinct, until it was rediscovered in the 1980s in the southern Flinders ranges by a plant enthusiast.

Although considered a perennial species, its life cycle appears closely linked to fire events within its natural environment, whereby it appears shortly after fire and persists until competition from other plant species becomes too great. With this in mind, the window of opportunity to collect and store seed for this plant is very narrow.

In October this year Dan Duval (Botanic Gardens of Adelaide Seed Collector) and Kieran Brewer (Native Vegetation Consultant) embarked on a field expedition to locate the plant in Mount Remarkable National Park (3 hours drive north of Adelaide). An intensive search was undertaken in an area that was burnt in late 2007. After much searching, an extremely localised population of approximately 1,000 plants was discovered. Seeds from these plants have since been collected and will be stored at both the Botanic Gardens of Adelaide and the MSB. Research will be undertaken by scientists at the Botanic Gardens of Adelaide to understand its seed biology, and the population will be monitored to determine its persistence and survivorship under natural field conditions.



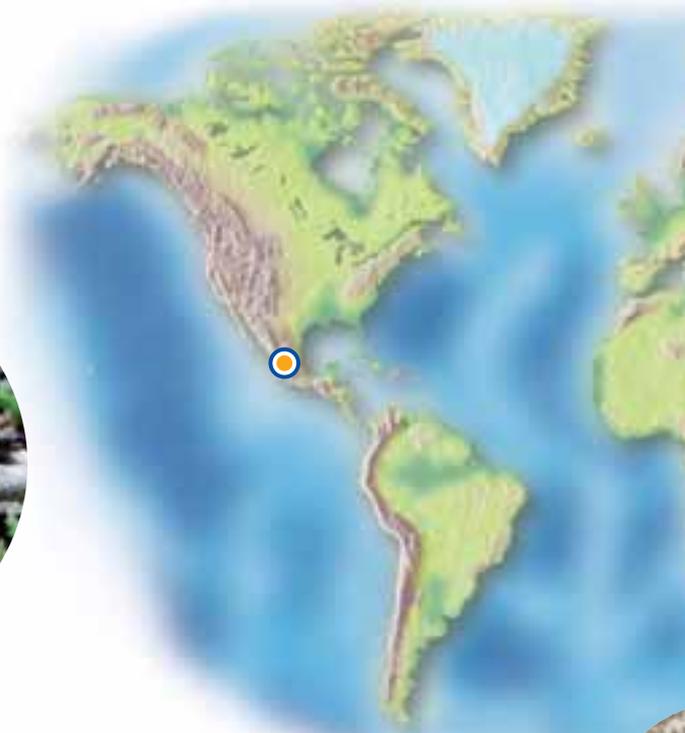
Central Asia

Seed collecting in the Kyrgyz Republic

2008 was the first year of the formal collecting collaboration between the MSBP and organisations in the Kyrgyz Republic. This is an exciting new partnership for the MSBP, and our first in Central Asia. The collaboration is managed by the Institute of Biotechnology of the National Academy of Sciences of the Kyrgyz Republic, which has developed the first seed bank for wild species in the country. Collecting is carried out by colleagues in the Institute of Botany, Biology and Pedology, also part of the Academy of Sciences.

Despite a heavy drought in summer 2008, the team managed to make 122 seed collections, the majority of which are new to the MSBP.

In September, Clare Trivedi and Keith Manger from the MSBP visited the team for the first time. During the trip a freezer was purchased which will provide long-term storage for the collections held in-country. Clare and Keith also gave technical advice on all aspects of their work.



Mexico and Chile

Exchange of expertise in seed banking

The MSBP Chile team at INIA's base seed bank hosted a useful technical visit by two researchers from the National Autonomous University of Mexico (UNAM). Isela Rodriguez and Lilia Garcia are responsible for seed processing and data management at the FES-Iztacala seed bank, UNAM. In order to provide a robust introduction to seed banking procedures and management, a two week visit was arranged to Chile in January 2007 to work with INIA's staff who have extensive experience in seed banking and propagation. During their stay the visitors learnt about seed bank management and reviewed each of the critical activities including participating in seed collecting, seed cleaning, and setting up and monitoring germination tests. The visit resulted in an interesting exchange of expertise allowing improvements to be made in procedures used by both teams. In addition to continuing communication, INIA and UNAM are cooperating in the regional cactus seed research programme.



Namibia

Highlights – January to October 2008

The 2008 seed collecting season started very early in Namibia, with the first trip on 2nd January. We aimed to collect the cliff-dwelling *Aloe dewinteri*, but were horribly disappointed, when not even one plant in the target population showed any signs of having flowered, nor of flowering soon. However, we were lucky to find some seed still on the highly localised endemic tree, *Kirkia dewinteri* (Kirkiaceae).

By late February the South of Namibia had received wonderful rains and we came across a lot of geophytes in full flower. Early in April we returned to get seed. We were just in time for some, while others were devoured by armoured crickets! We also found *Suessenguthiella caespitosa* (Molluginaceae), a species inhabiting cracks in the granite hills of the area, which had not been collected since 1923.

In June we had the opportunity to get into the thick bush near some





Clare Trivedi and Keith Manger with the Kyrgyz Seed Bank team



Suessenguthiella caespitosa

PHOTO: HERTA KOLBERG

seasonally flooded pans in north-central Namibia. Some real treasures presented themselves to us here! We found *Cromidon pusillum* (Scrophulariaceae), to date only collected once from a locality about 220 km east, and another from 1939 marked simply "Grootfontein". We have now contributed the first specimens of these species to the National Herbarium of Namibia!

During our seed collecting activities in the south, we often stopped at the Aus Information Centre because they provide the most delicious lunches. They asked if we could provide their community nursery with seed of indigenous succulents. It was decided that this should take the form of a collaborative project: MSBP could provide any excess seed to the Aus Information Centre in exchange for information on germination and propagation requirements; information that is scarce for Namibian plants and could be used by the National Botanical Research Institute. In May we

China

The expansion of seed conservation in China

Seed conservation activities are growing in China from the subtropical southwest to the temperate northeast region. Another 12 new collecting partners joined the National Seed Conservation Network by the end of July; five of them from the northern provinces of China which are the home for many endemic species and highly valued medicinal plants such as *Panax jinseng*, *Taxus cuspidate* and *Xanthoceras sorbifolia*. They will aim to safeguard the northern China flora and some coastal species against habitat loss and over-exploitation. The visit of Beverly Maynard of the MSBP Curation team in 2007 also reinforced the seed processing capacity in Kunming, helping us to deal with the massive collections from the current large-scale collecting programme in China.

China's National Seed Conservation Network was initiated and is maintained by the MSBP partner, the Germplasm Bank of Wild Species (GBWS) at Kunming Institute of Botany. With training and technology transfer from the MSBP, the network has contributed to the conservation of ca. 14,200 collections and 3,200 Chinese species so far, including 40% on the red data list (96 species). Under the agreement between the Royal Botanic Gardens, Kew and the Chinese Academy of Sciences, 4,000 threatened and endemic plant species from China are being targeted for conservation in the GBWS by 2010.

Paul Smith, Simon Linington, Robin Probert, Hugh Pritchard and John Dickie formed a MSBP delegation to Kunming to attend the international launch of the GBWS in 2008, China's largest seed bank for wild plant species. As part of the celebration, Paul Smith lodged seeds from 204 UK species at the new facility.



Euptelea pleiosperma

PHOTO: JIE CAI



Team collecting field data

PHOTO: JIE CAI

Jie Cai, International Collecting Co-ordinator, Kunming Institute of Botany, CAS.
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handed over seed of seven succulent species that we thought would easily sell in a nursery and of which seed was plentiful and quick to collect. We also supplied general information on growing succulent plants, as well as photos of the species in their natural habitat.

Herta Kolberg,
MSBP Co-ordinator, Namibia,
hertak@nbri.org.na



Handing over seed to the Aus community nursery

PHOTO: HERTA KOLBERG

A unique voyage for threatened plants

By Anne Cochrane, Department of Environment and Conservation, Western Australia

Banksia brownii, the feather-leaved banksia, is an iconic plant species from the South West of Western Australia. It is listed as critically endangered and is declining due to the effects of *Phytophthora* dieback disease and too frequent fires. It is highly possible that a changing climate may also affect the future survival of this species. With this in mind, seeds of the feather-leaved banksia have been collected and conserved under Western Australia's international partnership with the MSBP.

In April 2007 I visited the MSB, to work on these collections in collaboration with seed ecologist Matthew Daws. Experiments were established to understand limitations on germination and growth under different temperature scenarios, both in the laboratory and in the glasshouse. Some interesting findings were made, but the most important outcome was the number of young plants produced from the experiments. Normally seedlings would be 'scored' then thrown away, but because of the threatened nature of this species it was considered wise to keep the seedlings and bring them home to be used in planned reintroductions for 2008.

Stringent restrictions on the import of plant material into Australia meant that a permit from the Australian Quarantine Inspection Service (AQIS) was required to bring the plant material back into Australia, despite it being of Australian origin. To assure the Australian authorities that the plant material did not carry any 'foreign' pathogens, a phyto-sanitary health certificate was obtained from the UK government prior to re-entry into Australia. Due to international airline restrictions on the carriage of liquids and gels the seven small containers of seedlings growing in agar gel were required to travel in the hold of the plane. Though carefully packaged in polystyrene foam and wrapped well in plastic, there was some



Seeds of *Banksia brownii*
PHOTO: ANNE COCHRANE

doubt as to whether these seedlings would return to Australia in good enough shape to survive!

On landing back 'home', the seedlings were taken to the Kings Park nursery in Perth for nurturing until they were large enough for planting back into the wild. Seedling survival was very high despite their long trip in the hold of an un-pressurised aircraft. Of the original 165 seedlings put onto the plane in June 2007, 86 of the mountain form and 70 of the coastal form survived until planting in May 2008. Meanwhile, Department of Environment and Conservation scientists had located two possible planting sites. These new reintroductions sites are disease-free, and in May 2008 plantings commenced. Detailed demographic monitoring of the plants will be carried out to determine survival over time, information that is a vital part of any plant reintroduction.

This has been the first attempt to repatriate whole plant material from the MSBP back to its country of origin, marking a stepping stone in the global seed conservation partnership. Examples like this mean that research aimed at overcoming barriers to germination or understanding threats can be conducted on material held in the UK seed bank and the resultant seedlings can be returned to the country of origin for reintroduction into the wild. When threatened plants are involved, it is comforting to know that seedlings from research programs can relatively easily return home. For the feather-leaved banksia the increase in plants on the ground and knowledge of threatening processes associated with plant decline will increase the chances of the species' future survival.



Photos from left to right:

Eastern peaks of the Stirling Range National Park PHOTO: SARAH BARRETT

Young *B. brownii* seedlings in the greenhouse at the MSB PHOTO: ANNE COCHRANE

B. brownii seedlings in Perth's Kings Parks nursery prior to planting

PHOTO: LEONIE MONKS

DEC Flora Conservation Officer, Sarah Barrett and Science Division Officer, Tania Jackson, planting a seedling of *B. brownii*. PHOTO: SANDRA THOMAS

Munters Drying Cabinet

by Neville Walsh and Jeff Jeanes – RBG, Melbourne

Faced with a very limited working space and a calculated moderate throughput (thanks to Keith Manger for doing the sums), at the commencement of our MSBP partnership with the Royal Botanic Gardens, Kew, we took the option of having a purpose-built drying cabinet made, rather than creating a drying room for desiccating our seeds. The drying unit is a Munters MCS300, while the two-door cabinet itself, and the cooling unit were constructed, to Munters' specifications, by a local refrigeration manufacturer.

This machine has run reliably for over three years and has proved adequate for our project, with an annual throughput of about 100 species per year with a minimum of 4,000 seeds per species (bearing in mind the largest seeds in the Victorian flora are under 1 cm diameter, although some fruits, such as those of *Banksia*, are as large as 150 x 80 mm). Seedlots of most species have achieved the required moisture level (ca. 15% eRH) within a few weeks.

Being housed in a small room we needed to remove the moist air by connecting the outlet to the ducted system in our building. Other than this small modification, we have had no need to change the original setup.

For projects involving larger seeds and fruit, more species per year and/or more seeds per species, larger or multiple units would most likely be required.

Supplier

Munters Pty. Ltd.
Head office Albury
N.S.W., email
maualbury@
munters.com.au



Munters cabinet



Munters drying unit

Specifications

Price: ca. \$24,000 AU (in 2005)
Volume: approx. 1.1 cubic metres
Drying capacity: 2.55 L/hr
Set at 15°C and 15% RH

Advantages

Relatively cheap to buy, run and maintain. Portable. Constant temperature and humidity throughout the cabinet (in larger spaces, such as drying rooms, these can fluctuate significantly in time, or vary from place to place). Easy to clean and control insects and other pests.

Disadvantages

All cleaning, counting and testing of seeds is conducted outside the drying cabinet leading to the possibility of the seeds partially rehydrating during processing. Due to small size, during peak collecting times the drying cabinet is generally fairly crowded and accessing collections can be time consuming.

Conclusion

The use of a drying cabinet is a very attractive alternative to a drying room, particularly for moderate budget and capacity projects.

Commercialisation of *Vernonia galamensis* (the potential ozone saviour) requires a better understanding of its germination by Desterio Nyamongo, Genebank of Kenya

Vernonia galamensis (Cass.) Less. (Asteraceae) is a potentially new industrial oil crop that is widespread in East African countries. On a dry mass basis, seeds of *V. galamensis* contain 35-45% of a triglyceride oil which is rich in vernolic acid, a naturally epoxidized fatty acid. There is a latent industrial use of these oils in the production of oil-based paints where it is possible to radically reduce emissions of volatile organic compounds into the atmosphere during the production and use of these paints. In addition, the seed meal left after the oil extraction process is a valuable source of crude protein, carbohydrate and many major minerals giving it exciting potential as an animal feed.

The problem we have is that the seeds of this species are intrinsically dormant and appear to lack any synchrony in germination. If this species is to be suitable for commercialisation it will be necessary to understand the regulation of seed germination. My study tested the hypothesis that *V. galamensis* seeds are dormant and require cold stratification and/or dry after-ripening for dormancy release. The study also tested the hypothesis

that the seeds display positive responses to light, alternating temperatures, gibberellic acid and nitrate. In addition, the study tested whether secondary dormancy can be induced by incubation in the dark. I used two sub-species, *V. galamensis* subsp. *nairobiensis* and *V. galamensis* subsp. *afromontana* var. *gibbosa*, which were each planted and grown at two distinct locations in Kenya. Results show that seed germination of the two sub-species is affected by temperature during seed development, with non-deep physiological dormancy of these light, gibberellic acid and nitrate sensitive seeds broken by dry after-ripening and cold stratification. In addition, we are now clear that seeds of *V. galamensis* subsp. *nairobiensis* are more dormant than those of *V. galamensis* subsp. *afromontana* var. *gibbosa*. It appears from this study that seeds produced in warmer environments are less dormant than those from cooler environments. *V. galamensis* is just one topical example of the many thousands of wild plant species in Africa whose commercialisation may prove to be such an important component of the highly fragile rural livelihood still relied upon in my country.