



samara

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

Bioinformatic methods in the planning of collecting efforts in Mexico

Natural history collections can contribute much in dealing with problems of conservation, prediction of invasive species, global climate change and public health. Better networks and more widely available electronic databases have enabled scientists to explore biodiversity on a large scale. However, certain caveats should be considered when using such databases. The raw specimen information must be analysed critically for four main reasons:

- Specimens may have faulty or insufficient georeferencing
- Specimens may have inconsistent or incorrect taxonomic identification
- Collection data has a spatial and temporal bias that must be offset
- Sufficient relevant information must be obtained from the database in order to produce a robust analysis

Even considering these problems, databases are useful for studies regarding distribution and richness. The specimen-based collections from Mexican and overseas institutions, housed electronically in Conabio (<http://www.conabio.gob.mx>), are checked before the data is placed in the database by georeferencing manually, followed by taxonomic validation to solve some of the problems of submitted datasets. The spatial and temporal bias, as well as the question of accessing sufficient relevant information for adequate analyses, is partially solved by increasing the volume of information in the database. This is done by databasing as many specimens from national and overseas institutions as possible. The Conabio database of vascular plants contains nearly 1.5 million records.

Unfortunately, due to factors like budget limitations, short term funding, and localised expertise, specimen collection is usually not sustained over long periods of time and few areas are collected systematically for any reasonable period of time. In addition, in megadiverse countries, the complexity of biodiversity adds to the problem, since detailed explorations are required.

One way to plan and maximise the collection effort in a megadiverse country is to apply GIS technology and to use electronically available datasets, such as those maintained by Conabio. The geographical representation of data points is a first approximation of what has been collected and when and where.

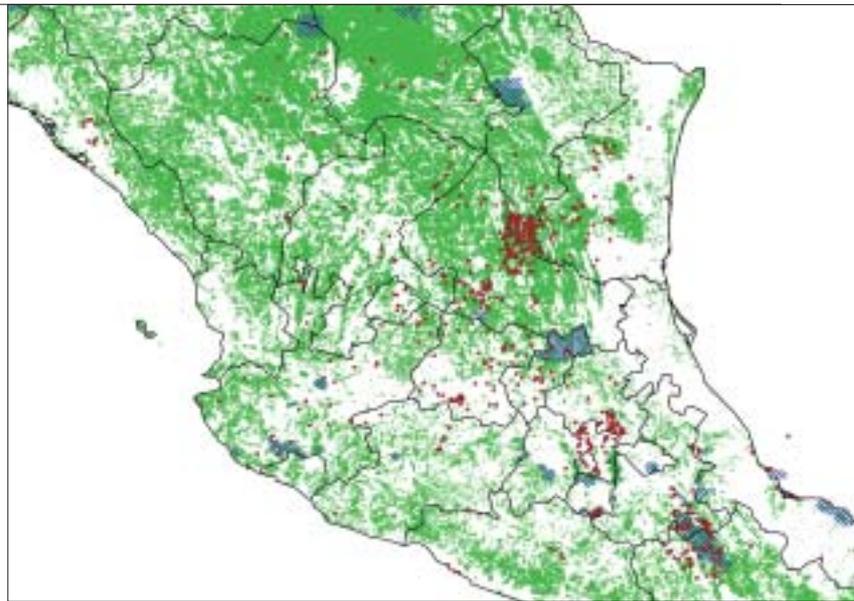


Figure 1: A close-up of central Mexico, showing collection points (in red) of Cactaceae species. The 3,058 Cactaceae data points in the figure were extracted from the Conabio database of nearly 1.5 million records. Areas with natural vegetation cover are shown in green and protected areas in blue. Areas with a high collection effort and natural vegetation can be easily identified as well as areas that have been poorly collected.

Conversely, when using these databases, we can identify areas that have been poorly collected or areas that have never been visited (Figure 1). In order to plan future collections, it is possible to combine different electronic layers, looking for particular combinations of unexplored ecological features. This kind of approach has been pioneered in Australia. In addition we can use potential distribution algorithms such as GARP (Genetic Algorithm for Rule Set Prediction, also developed in Australia) to identify potential research areas for a specific species (Figure 2, see page 4). These algorithms are an invaluable predictive tool for species distributions and for collections, and can even discriminate between taxonomic problems or assign biogeographical varieties.

The potential of public electronic databases, GIS technology and recent algorithms for analysis of biological phenomena is enormous and steadily growing.

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A selection of international programme activities

USA

Marcia Hermann, land steward at the Lady Bird Johnson Wildflower Center in Texas, has been busy over the summer of 2002, collecting seed from plant populations on the Wildflower Center's own land. Around 50 seed samples have been collected so far, including the 'skeleton plant' *Lygodesmia texana*. Marcia and her colleague Flo Oxley joined participants in RBG Kew's Seed Conservation Techniques course in September. Flo heads up the Wildflower Center's plant conservation program and she is seeking to develop project links with other botanists in Texas, including the Mercer Arboretum.

More than sixty botanists have been assisting the Seeds of Success Programme (see www.nps.gov/plants/sos for more information) in the USA in 2002. As a result of their efforts, over 350 collections have been received at the Wellcome Trust Millennium Building (WTMB) in the UK and are being processed. Project links are developing with Chicago Botanic Garden botanists interested in conserving and studying seeds from the Prairie flora of the Mid-West. Native Plant Societies are also being invited to participate in the program, and interest has been shown from the Virginia and New England Societies.



Right: *Astragalus preussii* collected on 30 July 2002 from Garfield County, Utah by the Grand Staircase Escalante National Monument team



Chile

Mario Leon, the newly recruited collector based at INIA's Vicuña gene bank, is making the first seed collections of the Chilean summer, and Michael Way worked with the INIA team during a field trip in the La Serena area in November 2002. Among the seed collections made, one was from a *Nolana* species shown here in flower in September. INIA and RBG Kew will contribute to seed research within the CEAZA project being developed in Chile, and more capacity-building activities are being discussed to strengthen the project still further. MSBP activities in Chile are generously supported by Rio Tinto.

Left: *Nolana* (blue) and *Leucoryne* (white)



Mexico

Juan Ismael Calzada continues to lead UNAM's monthly collecting programme in the Tehuacán Valley, and UNAM is consolidating its developing research programme within the MSBP. This was assisted through a visit by Dr Hugh Pritchard, from RBG Kew's Seed Conservation Department, who was invited by the Universidad Autonoma Chapingo to lecture on an *ex situ* conservation course co-organised with IPGRI. Hugh gave two lectures on Seed Storage Behaviour and Seed Drying and the Viability Equation.

Burkina Faso – Mali

After signing an Access and Benefit-Sharing Agreement (ABSA) with the Centre National de Semences Forestières (CNSF) in Ouagadougou in Burkina Faso in September 2000, much joint collecting and research has taken place. As the CNSF is a forestry institute, the first missions concentrated on trees and shrubs, with a wider focus later on on annual herbacées. Since late 2001, the collecting activities have been carried out throughout the year by CNSF staff only, supported remotely by Seed Conservation Department staff from RBG Kew. To this end, an expedition vehicle was bought locally. In addition, a batch of glass containers has improved the storage of seed samples in Burkina, while computerised data registration of the seed holdings can now also be carried out. A large shipment of the first 112 duplicate collections arrived at the WTMB in the UK in June 2002.



Left: Collecting *Combretum fragrans*
Right: Collecting *Usteria guineense*

Whilst on a joint expedition in late 2001, the MSBP co-ordinator, together with two staff of the CNSF, made a foray into the adjacent Republic of Mali in order to try to establish a formal collaboration there as well. Visits were paid to the Centre Régional de la Recherche Agronomique (CRRA) in Sikasso and its parent organisation, the Institut d'Économie Rurale (IER) in the capital Bamako. This resulted in a draft project document, which was discussed, together with a draft ABSA, during a visit to Mali in late November 2002.

Meanwhile scientific collaboration with the CNSF continues. RBG Kew currently hosts a visiting research fellow at the WTMB, working on seed storage longevity of tropical tree species.

Namibia

Two seed collecting missions were recently undertaken into the Erongo, Khomas and Hardap regions of central Namibia to collect indigenous species prioritised for collection by the National Plant Genetic Resources Centre, a partner in the Millennium Seed Bank Project. The collecting team, comprising Herta Kolberg, Sonia Loots and Rennie Moses, spent 24 days in the field, including 9 days on the Brandberg. A total of 61 accessions were collected, of which 60 were sent for duplicate storage at the Millennium Seed Bank. Of the accessions collected, 10 species fell into the 'priority' group, 23 were endemic, 7 near-endemic and 36 had some known use. Interesting endemic species collected included *Acacia montis-usti*, *Othonna brandbergensis* and *Ruellia brandbergensis*.

Left: *Ruellia brandbergensis* (Acanthaceae), a Namibian endemic species recently collected on the Brandberg in central Namibia. (PHOTO: HERTA KOLBERG)



Left: collecting *Juniperus phoenicea*, northern Sinai desert
Far left: Egyptian Deserts Gene Bank, North Sinai



Above: Collecting the tall *Erythrophlaeum guineense*



In addition, an MSc student working on recalcitrant seed of *Vitellaria* is supported in Gembloux, Belgium. Another MSc student at the WTMB compared seed storage conditions at the CNSF and the MSB in order to advise on improving those of the former. Lastly, an application for funds from the Darwin Initiative was supported for a project on research, training and information exchange of 16 Sub-Saharan tree seed centres. These include the CRRA in Mali and the CNSF in Burkina, leading to a possible closer collaboration between the two.

Western Australia

The Western Australia partnership is now well into its second collecting season, having successfully made collections from some 240 species over the past year, many of which are from rare and endangered species and certainly all new to the MSB collections. The Kings Park Botanic Garden team has been strengthened by the appointment of Katie Biggs as seed collector to support the work of the Seed Technology Centre headed by Luke Sweedman. Andrew Batty now co-ordinates the collection of orchid seed and associated fungal symbionts. At the Department of Conservation & Land Management, Anne Cochrane is concentrating on target species from the South West corner of WA whilst Andrew Crawford continues his seed collecting activities from sites north of Perth. James Wood from RBG Kew's Seed Conservation Department Curation Team visited WA over December 2002 and undertook seed collecting trips with Luke in Kalbarri National Park and Anne in the Sterling Ranges. George Mugambi, one of our Kenyan partners, attended an orchid conservation workshop in Perth during 2001 and we hope this leads to greater collaboration between WA and Kenya in the area of orchid conservation research.

Egypt

The Egyptian Desert Research Center has Departments for Plant Genetic Resources, Medicinal and Aromatic Plants, and Ecology and Range Management, as well as the 'Egyptian Genebank for Desert Plants'. Following the conclusion of an Access and Benefit-Sharing Agreement between the RBG Kew and the Desert Research Center, joint collecting, training, provision of equipment, and research has resulted. Seed collecting expeditions took place in the Sinai in 2000, in the remote mountains of Gebel Elba near Sudan in 2001 and along the Mediterranean coast in 2002. The trips in 2002 also heralded the shift to collecting throughout the season by the DRC alone, supported remotely by Seed Conservation Department staff from RBG Kew.

The DRC principal counterpart participated in the Seed Conservation Techniques course at the WTMB in September 2002 and concluded that conservation procedures at the DRC seed bank will be reviewed as a result of this. In addition, the DRC received a GPS unit and equipment for non-invasive measurement of relative humidity in order to check the moisture content of seeds in storage. More complete data gathering and improved seed storage will now result.

Furthermore, a DRC staff member worked at RBG Kew's Jodrell Laboratory for three months during the first half of 2002 on conservation genetics of five rare species (including *Juniperus phoenicea*, see illustration) from the Sinai Peninsula. This was in support of her PhD research.

CITES – a brief summary

The Convention on International Trade in Endangered Species of Wild Fauna and Flora, or CITES, was established in 1973. An initiative of the IUCN, it was initially signed by 21 countries and came into effect in 1975. Today over 150 countries are party to the Convention.

The Convention was established with the aim of controlling and monitoring the international trade in plants and animals considered to be threatened, or likely to become threatened, and affected by such trade.

Around 25,000 plant taxa are subject to controls. The main groups covered are the Orchidaceae, Cactaceae, succulent euphorbias, aloes (except *Aloe vera*), all cycads, *Nepenthes* spp., *Sarracenia* spp. *Galanthus* spp., *Cyclamen* spp., and some timber species. Controls are not limited to live plants, but may include, for example, seeds and herbarium material.

The Convention does not prohibit the international trade in listed species, but seeks to prevent the unsustainable exploitation of wild populations of plants and animals. The Convention consists of a text setting out the main 'rules' and three Appendices, or lists, of plants and animals. Trade in species listed in these Appendices is controlled and monitored by means of a permit system. In CITES terms, 'trade' means international movement.

In the 15 countries of the European Union (including the United Kingdom), CITES is implemented by means of EU Regulations. These Regulations mean CITES operates slightly differently in EU Member States and under stricter controls. In the European Union the CITES Appendices are replaced by Annexes. The table below summarises the taxa included in the Annexes:

Annex Taxa included

- | | |
|----------|--|
| A | Equivalent to CITES Appendix I. Includes CITES Appendix I species and species for which the EU takes stricter measures. |
| B | Equivalent to CITES Appendix II. Includes CITES Appendix II species and species for which the EU takes stricter measures. |
| C | CITES Appendix III species. |
| D | Non-CITES species for which import levels into the EU are being monitored. |

There are special provisions for the free movement between CITES registered institutions (i.e. both institutions must be registered) of non-commercial loans, donations and/or exchange of herbarium specimens, other preserved material, dried or embedded museum specimens and live plant material which carries an approved CITES label. This scheme applies to material for official research purposes only. Material must already be part of collections, i.e. the scheme cannot be used to bypass CITES permits for recently collected field material.



CITES and how it affects you

Before sending any material to the Wellcome Trust Millennium Building at Wakehurst Place, please send a list of Family, Genus and Species and whether your material is seed, herbarium material or both. Contact details can be found at the end of this article.

The Plant Health Officer will check your list for CITES species and reply to you within one working day.

If you choose to send your material without a list being checked beforehand, you run the risk of breaching regulations. If this happens, the material will be seized by Her Majesty's Customs and Excise and destroyed.

An export permit from your own authorities is not sufficient. The MSBP needs an import permit, issued in the UK, in order for the material to be imported legally into the UK.

Import permits can be obtained if sufficient time is allowed.

If you know your country is not a CITES signatory, or if you are not sure, please let us know as other documentation may be required.

If you have any queries concerning CITES or Plant Health, please contact the MSBP Plant Health Officer:

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Bioinformatic methods in the planning of collecting efforts in Mexico Story continued from page 1



Figure 2. Potential distribution of *Opuntia tapona* (Cactaceae) using GARP and 1:1,000,000 climate coverages. Current collection points are shown in red and potential distribution in green. The data point to the south could be an incorrect taxonomic identification or inaccurate georeferencing.

From a strictly biological point of view these tools provide invaluable information on the current status of collections at different geographical scales thus enabling a more rational use of resources for institutions planning collections. Technologies such as the one described above will be used in the collaborative MSBP project between the National University of Mexico and RBG Kew.

Using these tools will help plan and prioritise collections, monitor and execute projects and develop regional initiatives. Information about current and future collections will have value, not only for the biological sciences, but also for informed decision making in all aspects of biological diversity.

For more information, contact:

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Seed Notes provide a wealth of information on Western Australia's native species

In August 2002, the Perth branch of the Wildflower Society of Western Australia and the Western Australian Department of Conservation and Land Management, a partner in the Millennium Seed Bank Project, launched the publication *Seed Notes*. These twenty vibrant brochures, packaged in a colourful folder, document information ranging from licensing requirements for conducting seed and flora collections within the State of Western Australia to handy hints on seed collection and germination testing. The brochures are A4 in size and consist of 2 pages, double sided in full glossy colour. The first three brochures cover introductory information (the importance of seeds, their dispersal mechanisms, shapes and sizes and information on conserving seed), seed collection techniques (including a comprehensive glossary and some recommended reading), and seed quality and germination testing. Seventeen of the brochures describe common genera found within Western Australia. Information on plant description, geographic distribution, reproductive biology, seed collection, seed quality assessment, germination and recommended reading for the genus is provided in each of these brochures. More than a hundred colour photographs of seeds are supplied, providing the novice and expert alike with easy identification of seed types for different genera. Many of the genera included in the Seed Notes are those highly prominent in the species-rich heathlands and woodlands of the South West of Western Australia. Included are *Adenanthos*, *Banksia*, *Conospermum*, *Dryandra*, *Grevillea*, *Hakea*, *Lambertia*, *Isopogon* and *Petrophile* in the family Proteaceae; *Eucalyptus*, *Darwinia*, *Chamelaucium* and *Verticordia* in the family Myrtaceae; *Lasiopetalum*, *Thomasia* and *Guichenotia* in the Sterculiaceae family; *Eremophila* (Myoporaceae), *Acacia* (Mimosaceae), *Allocasuarina* (Casuarinaceae), *Hibbertia* (Dilleniaceae), *Hemigenia* and *Hemiandra* in the Lamiaceae and a range of hard-seed pea genera from the Fabaceae.

Financial assistance for printing these Seed Notes was kindly provided by the Gordon Reid Foundation of the Western Australian



Lotteries Commission and obtained through the Perth branch of the Wildflower Society of Western Australia.

The beautiful layout and cover design were prepared by the Department of Conservation and Land Management's Graphic Design Section from the original concept by botanist Grazyna Paczkowska.

The Seed Notes were written and compiled by the Manager of the Department's Threatened Flora Seed Centre in a bid to bridge the gap between science and the public through the provision of easy to read information for community and landcare groups with an active interest in seed collection, germination and revegetation. An additional aim in preparing these Seed Notes was to promote the unique flora of Western Australia and ultimately to gain support for *ex situ* conservation throughout the State. It is anticipated that further brochures will cover additional genera in the series, and that one day the Seed Notes may be available on the world wide web. For the time being, the set of 20 brochures is available for sale at AU\$10 from the Department of Conservation and Land Management or the Wildflower Society of Western Australia in Perth.

The ultimate aim would be to see other project partners compile similar information for their own countries or regions so that many more people may benefit from the partners' scientific endeavours. A wealth of information will be gathered over the next decade or more on seed maturity, timing of collections, the collection process itself and the methods for germinating a range of native species from all of the partner countries. Much of the information gained through project work is unlikely to be published in scientific journals and as such will remain unavailable to the public, who support the project's outcomes. A publication such as Seed Notes may ensure that valuable information is disseminated to a wider audience.

Anne Cochrane

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Inaugural congress of the African Botanic Gardens Network

Following the adoption of a Global Strategy for Plant Conservation under the Convention on Biological Diversity, African botanic gardens have come together to produce their own strategy for plant conservation. At the inaugural congress of the African Botanic Gardens Network, held at Durban Botanic Gardens, South Africa, from 25-29 November, delegates agreed a constitution for the Network and an Action Plan to focus its members in their work. The Congress was attended by representatives from 21 African states and was opened by the South African Minister of Environmental Affairs and Tourism, Mohammed Valli Moosa.

The Congress was attended by representatives from four MSBP partner institutes: National Botanical Institute of South Africa, National Botanical Research Institute, Namibia, the National Museums of Kenya and RBG Kew, UK. These institutes will now start working, together with the other members of the new Network, to meet the targets agreed under the Action Plan.

The African targets are based around those in the Global

Strategy for Plant Conservation but fit more closely with African capacity and priorities. The African Botanic Gardens have agreed a target for 40% of threatened plants to be held in accessible *ex situ* collections, preferably in the country of origin, by 2010. With its aim to conserve 10% of the world's seed bearing flora by 2010, the MSBP can make a considerable contribution to meeting this target. Last year African partners were responsible for over half the seed collections made and conserved by the MSBP.

The MSBP also has a lot to contribute to the capacity building targets in the Action Plan such as training workshops. The Plan also includes targets related to understanding and documenting plant diversity, conserving plant diversity *in situ*, using plant diversity sustainably and promoting education and awareness about plant diversity.

Copies of the Action Plan can be obtained from the Acting Co-ordinator of the Network, **Chris Dalzell** at Durban Botanic Garden (email: Dalzellc@prcsu.durban.gov.za).

NEWS

Small seeds, big numbers

Staff from the Research Section of the Seed Conservation Department at RBG Kew have made the largest single seed collection (based on seed numbers) since the Seed Bank started at Wakehurst Place in 1973; possibly the largest ever made in the world!

During August, Chris Wood, Helen Vautier, Matt Daws and Emily Lydall sourced 216 individual Common Spotted Orchid plants (*Dactylorhiza fuchsii* (Druce) Soó) and subsequently harvested a small quantity of capsules from each. These seeds weigh only 3 µg each and the total collection size has been estimated at 8 million seeds, enough to fill an MSBP mug. The seeds will be used for both banking within the MSB and collaborative research work with Kenyan and Australian partners.

For more information contact:

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An MSBP mug containing 8 million *D. fuchsii* seeds

Anglo American plc supports Pan-African seed conservation

In 2001, Anglo American plc agreed to a ten-year programme of support for the Millennium Seed Bank Project. Donations from Anglo American are being used to develop a Pan-African fund which supports projects across the continent from Egypt to South Africa and from Burkina Faso to Kenya. Among the projects supported are capacity-building activities such as training in plant conservation for scientists from developing countries and support for developing smaller in-country seed banking facilities to keep duplicate sets of seeds in their country of origin.

Seed Conservation Techniques 2002 course



Participants on the recent Seed Conservation Techniques training course held at the Wellcome Trust Millennium Building from 9-20 Sept 2002. The 2-week residential course brought together MSBP partners from eight countries, sharing their experiences and building their skills to collect, conserve and manage *ex situ* seed collections.

Titus Waiganjo Wambugu 1958 - 2002

It is with great sadness that I have to report the untimely passing of our friend and colleague Titus Waiganjo, an active participant in the Seeds for Life Project, the Kenyan partnership of the Millennium Seed Bank Project.

I have personally known and worked with Titus for over a decade, through dry Acacia scrub, wet coastal forests and the montane grasslands of his native Central Province. His enthusiasm for his work, his passion for plants and his infectious attitude to life will remain with all of us who were fortunate enough to work with him.

It was during a recent joint seed collecting mission to Eastern Kenya that Titus fell suddenly ill and left us to seek medical attention back in Nairobi. Sadly, the next time I saw Titus was 2 months later in hospital having been

diagnosed with colon cancer. He died the following day.

A strong family man, Titus leaves his wife and three children for whom he worked tirelessly to support through their schooling. The East African Herbarium has lost a valuable member of its staff and our seed collecting efforts will be the poorer for his absence. His colleagues have lost a dependable friend and we will remember him with fondness and probably a wry smile. Such was his way, Titus made us all laugh.



Tim Pearce

Kenyan University offers plant genetic resources diploma

In 2001, Maseno University in Western Kenya, launched a *Diploma in Plant Genetic Resources Conservation and Utilisation*. The diploma is intended to help solve the manpower shortage in this field and to equip participants with the necessary skills for appreciation and management of plant genetic resources (PGR). It has been developed in close consultation with other PGR stakeholders in Kenya and is focused on addressing client needs.

Tuition fees for this 12-month diploma (one and a half academic years) are US\$3,000, excluding living expenses, which are estimated at US\$200/month.

In 2002, eight candidates, drawn from three Kenyan research institutions, undertook the course courtesy of the MSBP-supported *Seeds for Life* project in Kenya. The *Seeds for Life* project addresses conservation and utilisation of PGR in Kenya. It is a partnership between five Kenyan

organisations (the Kenya Forestry Department, the Kenya Agricultural Research Institute, the Kenya Forestry Research Institute, the National Museums of Kenya and the Kenya Wildlife Services) and the Royal Botanic Gardens, Kew through the Millennium Seed Bank Project (MSBP).

Twenty five candidates, drawn from eight countries within East and Central Africa (Ethiopia, Uganda, Malawi, Namibia, Botswana, Zambia, Kenya, and Tanzania), have so far shown interest in undertaking this diploma in the 2002-03 academic year. Some places remain and candidates wishing to participate should contact:

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WE WANT TO HEAR FROM YOU!

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