BRAHMS
BOTANICAL RESEARCH AND HERBARIUM MANAGEMENT SYSTEM

A review of BRAHMS projects and activities to October 2004.
Annex for Forestry Research Programme (FRP) final report R7276E.

A poster prepared by the herbarium at Embrapa Amazonia Oriental, one the three principal Brazil-Amazonian herbaria. The poster lists the benefits of BRAHMS to the project and indicates sites of BRAHMS training courses provided by Embrapa in Brazil.
BRAHMS activity highlights for 2004

- BRAHMS online was published with help from FRP.

- After an evaluation of various herbarium data entry options, BRAHMS was selected by RBG Kew to assist with their Millennium Seed Bank Enhancement project. The target is to enter data from 100,000 specimens of endemic, endangered and economically important species over the next 3 years; to prepare ‘Collection Guides’ for seed collection teams; and to develop a BRAHMS species information database to support the seed collection work.

- Together with Embrapa Amazonia Oriental in Brazil, a Darwin Initiative grant was submitted in October 2004 entitled ‘Enhancing plant diversity information in Amazonia to strengthen conservation planning’. The Embrapa project is providing BRAHMS training in different parts of North Brazil. It has been well supported over the last several years from the bilateral DFID project Dendrogene.

- The most significant publication from BRAHMS for 2004 is the monograph of the Cupressaceae written by A. Farjon, RBG Kew.

- The New York Botanical Garden NYBG has elected to adopt BRAHMS to replace their distributable system developed for external projects.

- Singapore Botanic Garden completed digitizing their type collections. An article describing his has been published in the Singapore Botanic Garden magazine.

- During August, short training courses were given at the 4 main herbaria in Bolivia (La Paz, Cochababma, Sucre and Santa Cruz).

- Four software upgrades were released during 2004 (Versions 5.53 through 5.56), all fully documented on the main BRAHMS web site.

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1 Introduction

1.1 About his document

This document, prepared as an annex for FRP final report R7276E, brings together information about BRAHMS Projects. Where available, links to web sites and/or project coordinators are provided, publications are cited and comments on project status given.

Feedback is still awaited on some 20% of projects contacted. There are also a substantial number of projects that use and regularly upgrade BRAHMS but provide little if any feedback. Some of these can be picked up in Section 8 on database registrations.

It is now intended to extend and re-format parts of this document into a data table and to make this available online, cross referenced to project websites and relevant sources of data.

1.2 BRAHMS introduced

BRAHMS is database software for botanical research and collections management. It provides comprehensive support with the management of species data, collection curation and taxonomic research. The system can be used to create different types of products from standard lists, loan forms, labels, tables, checklists, graphs and maps to more complex summaries, indexes, monographic publications formatted for specific journals and biodiversity calculations. Databases may also be published online.

BRAHMS is essentially a species or taxonomic information system. Dictionaries of taxonomic names form the database backbone and provide a framework for other data categories including collections. All BRAHMS databases store species data but not all store collections data. Some projects are solely concerned with assembling species names and facts about these species.

Where herbarium management is the priority, inevitably, the emphasis of work will be with collections, certainly during the initial stages of database development. In these projects, species data may never graduate beyond the basic name and author. However, as such databases mature and the collections are gradually brought under control, opportunities usually arise to enrich the database with nomenclature and other facts about the species, expanding output potential.

Image management functions were integrated with BRAHMS during 2003. In this screen, all the images of one collection held at different Brazil Amazonian herbaria (IAN, INPA and MG) are brought together for comparison together with a specimen duplicated to Kew.
1.3 FRP support and BRAHMS development history

The BRAHMS Project was initiated and largely developed with support from the DFID Forestry Research Programme (FRP). Database work in general started in 1985 under ODA Research Scheme R3881 1984 -1987 (The Development of Breeding Populations and Genetic Improvement Strategies for Tropical Pines). Database work during that project started on seed lot and provenance trial management, this work leading to development of the SISTEM database (Species Information Seed, Trial and Environment data Management) as described in ’Filer, D.L., A Database for Tree Improvement and Seed Bank Management, Commonwealth Forestry Review 67(3) No 212. 1988’. All of the initial work was on mainframe computers as microcomputers and suitable PC database software were unavailable.

Database development was continued under R4369 1987- 1989 (Expansion and Integration of the Oxford Forestry Institute Tropical Forest Resources Database). In the summary of the final report for R4369 is found the text “A microcomputer version of the herbarium database known as BRAHMS (Botanical Research And Herbarium Management System) is currently being prepared. By distributing this database to research collaborators and key herbaria, it will be possible to coordinate and standardize the collection of fundamental botanical information on species of interest with significant implications for basic tree improvement research and taxonomy in general”.

In the same report, section 2.4 can be found ‘Funds for the development have been made available through the ODA/OFl Manpower Centre Scheme in collaboration with the ODA Forestry project in Honduras and through the ODA R&D project R4526 (the study and acquisition of genetic resources of Acacia karroo)’.

Work was continued under FRP R7276 August 1998 - March 1999 (Distribution of monographic data-sets of Calliandra, Inga, Leucaena, Parkinsonia, and Pinus in electronic format – a model for future dissemination of botanical data). During 2004, a 6 month extension was allotted by FRP (R7276E 1 March 2004 to 31 August 2004) to promote the publication of BRAHMS databases on the internet using BRAHMS online.

The extension to R7276 has made a further contribution, in particular, helping to distribute valuable botanical information via the newly developed BRAHMS online service.

Many of the projects summarized in this document are then a direct result of earlier and strategic FRP inputs and FRPs recognition of the importance of basic research of this type to the overall development process.

1.4 The relevance of BRAHMS to development and DFID

The BRAHMS project assists the development process by improving the botanical data infrastructure and by distributing information about plant species as widely as possible. The project is demand driven and operates in a broad spectrum of countries, encouraging the exchange of data and expertise.

Primary botanical data, as found in herbaria, are the starting point for identifying and building up knowledge about species. Numerous species have links to forestry, agroforestry, agriculture and host of further economic disciplines. New genetic sources are continually being sought for food and crop development, pharmacology and drug development, natural pesticides, herbicides, fibers and dyes, timber and related wood products, weed control, horticulture, animal fodder and more.

In many countries, there is still a vast amount to learn and understand about local species - their economic potential as well as their conservation status and overall importance ecologically. This is often especially the case in the less developed countries where species richness can be high,
resources to document the diversity low and mechanisms to control conservation of critical habitats lacking.

DFID target countries are often seriously under-resourced in the various tiers of research institute that provide information about their biological resources, including plant species. It is the case that such countries often have a complex kaleidoscope richness of biodiversity and that this is often seriously threatened by accelerated economic development.

Herbaria work at the lowest level of botanical knowledge, helping to know the differences between one species and other and to be able to gather together facts about species and put this into the correct ‘box’. Without good species naming, which in turn has to be linked to the physical plant specimens stored in herbaria, confusion arises and it is very difficult to make reliable statements about individual plants and species. This in turn confuses ecological statements and all categories of biodiversity and conservation study.

Development and conservation of natural resources go hand in hand. To provide meaningful conservation support, improvement is needed in two principal areas: reliability of species identification and knowledge of species’ distributions. This must be combined with greater dissemination and use of the relevant data. The ultimate source of these data resides with decades of botanical collections held in the regional herbaria. However, the inaccuracy of the identifications, and the lack of quality control of the data-set they represent, can hinder rather than assist with biodiversity assessment and conservation judgments.

There is thus a real need to build capacity in this area, empowering local communities and government research institutes, through training and the provision of information, to have greater understanding of and control over their natural biological resources.

The herbarium of Embrapa Amazonia Oriental, Brazil. The herbarium holds c.180,000 specimens, all databased in BRAHMS, many with digital fotos.

Specimens such as the one being examined here are commonly ‘duplicated’ across various herbaria. In other words, different sheets of exactly the same collection are stored in more than one herbarium, often many.

Herbaria worldwide are full of wrongly identified specimens – and this has negative consequences across the board for biodiversity research, prioritizing conservation areas and other aspects of plant use. Yet the same specimens have often been correctly identified in a centre of excellence or in a herbarium fortunate enough to have had a specialist visiting botanist.

One of the purposes of BRAHMS is to optimize the processes of data exchange between herbaria, helping to improve the reliability of specimen naming.

1.5 The role of larger international herbaria

Although BRAHMS projects also work with projects in countries with good or even excellent resources, for example Singapore and the USA, projects in these countries, almost without exception, are of benefit to less developed countries.
The larger international herbaria are often well endowed with collections from and specialists in resource poor countries. By working with these herbaria, BRAHMS projects are able to document and distribute data more widely, either as actual data (e.g. BRAHMS online) or as publications (e.g. World Conifer Checklist). These projects are also a source of income to help run the project.

1.6 Seed Banks revisited

An important current initiative with BRAHMS development is the re-invigoration of the Seed Bank module. This is receiving a considerable boost from links to the Kew Millennium Seedbank project.

The task of fully converting the old DOS SISTEM+ Seed Manager and merging this into BRAHMS has been time consuming. However, this has largely been completed and the new system is now ready for use and has started to be implemented. During September 2004, the new system was implemented at the Alice Holt Seed Bank, UK Forestry Commission. Alice Holt has, over the years, provided a solid basis upon which to build good seed management practices into the database.

The Seedbank module of BRAHMS has been developed for seed banks and other seed handling projects including those dealing with the conservation of genetic resources. This component of BRAHMS was initially developed (from 1986) as a separate database known as the Seed Manager, part of SISTEM+. This database was developed by the tropical tree improvement research programme coordinated by the Oxford Forestry Institute (OFI) in close collaboration with the Seed Trading section of the UK Forestry Commission and the Malawi National Tree Seed Center, Forestry Research Institute of Malawi (FRIM). At the OFI, the Seed Manager has been in constant operation as a research and management tool since 1986. The UK Forestry Commission Seed Trading section and FRIM in Malawi have been using the Seed Manager to run the commercial seed handling operations since 1994.

The BRAHMS Seedbank module has only recently been fully incorporated into BRAHMS.

The Seed Manager manages and monitors all phases of seed handling from initial procurement to final distribution. A wealth of descriptive information can be stored for each seed lot including collection details, processing history, testing, certification, storage, ticketing, distribution and invoicing. The module also provides an overall perspective on seed supply and demand, helping seed banks to plan their annual seed procurement programme and to analyze seed distribution by species or customer group. Increasing the efficiency of each of these management areas...
leads towards higher quality and higher value seed being delivered to the end user and greater economic efficiency overall.

1.7 Summary of current BRAHMS use

Work on BRAHMS was started in 1985 at the Oxford Forestry Institute, Department of Plant Sciences, University of Oxford. The system is now being used to assist research departments and herbaria in Europe (Baltic states, Denmark, Germany, Netherlands, Portugal and the UK); Africa (Benin, Cameroon, Gabon, Ghana, Kenya); Middle East/Asia (Bangladesh, Indonesia, Kuwait, Malaya, Philippines, Sabah, Sarawak, Singapore, Thailand) and the Americas (Bolivia, Brazil, Colombia, Honduras, Panama, Puerto Rico, USA).

In addition to these mostly collection management projects, BRAHMS is also used by foresters, botanists and other type of researcher to manage their data. Many examples of research use (biodiversity summaries, synopses, checklists, monographic work, etc.) are provided in this document.

The first project outside the University of Oxford was started at the Paul C. Standley herbarium (EAP), Honduras in 1989. The largest databases to date are in the Netherlands where the Leiden, Utrecht and Wageningen databases have been growing since about 1995. One offshoot of this latter project is the Types of the Netherlands web site which includes c.40,000 images online.

Regional database networks are being established in Amazonian Brazil and the Netherlands and, with assistance from the Asia IT&C European Community Initiative, a web based project ‘South East Asian Collection Information Network SEABCIN’, started 1 November 2001, is assisting with data exchange between herbaria in Europe and South East Asia.

1.8 Dissemination

BRAHMS support has led directly and indirectly to numerous publications. Research papers, books, theses and other articles that make use of BRAHMS databases, continue to be published. Where possible, references are given in this annex. Various posters (e.g. front page to this report), leaflets, articles and other forms or promotional materials have been produced over the years together with numerous BRAHMS manuals in different formats. Manuals these days tend to be online HTML files or downloadable word documents, as described below.

A regular summary of annual activities is contributed to the Oxford Pant Systematics newsletter. Other articles are published from time to time as with the BioNET International contribution indicated below.
1.9 Documentation and language support

There is a growing body of BRAHMS documentation, all available on the Manuals page of the main BRAHMS website. About 20% of the documents are available in Spanish and Portuguese, for example the training guide ‘Introducción a la base de datos de BRAHMS y Leucaena. Ejercicios de entrenamiento para ser usados junto a la base de datos de BRAHMS Version 5 y Leucaena. 2nd Edición Mayo del 2003’. Translation costs come from BRAHMS project income.

Keeping documentation up to date is a sizeable task in its own right.
1.10 **Ongoing development**

BRAHMS software is continually being upgraded. Upgrades are posted on the main BRAHMS website on the Software page. Detailed revisions notes are provided for each revision in the Revision History section.

![BRAHMS Software Revision Notes](image)

1.11 **Funding and the need for further support**

The BRAHMS Project is continually striving to seek funds to support the improvement of all existing software and documents and for new developments. Funding is generally tight and project resources badly stretched given the high level of activity and user demand. Funds are raised through research grants (e.g. FRP R7276E), links to larger projects that arise from time to time (e.g. SEABCIN) and BRAHMS support agreements.

The arrangement with Support Agreements is that projects with resources are strongly encouraged to contribute annually and this does bring in about £5000 - £7000 per annum. Herbaria with resources (e.g. projects in Netherlands, Kew, Singapore, USA) do contribute annually and these inputs help to cover costs elsewhere.

It remains the policy of the BRAHMS Project to provide the system freely across the internet and to provide support where needed. It is hard to budget this kind of activity.

Modest research grants, such as that provided recently by FRP, are hugely beneficial to the project, providing resources to focus on a particular aspect of system development. If an appropriate funding window with FRP should appear again, a small highly focused project has been drafted to modernize all BRAHMS help and documentation. The project would:

- Consolidate all existing BRAHMS documentation, converting this to HTML help files to simplify future document updating, maintenance and translation.
- Merge this documentation with the existing BRAHMS online help system, thus creating a single source of documentation for standard and online use.
- Enrich the number of training exercises and examples such as those currently provided on the ‘BRAHMS for Beginners’ Training Manual.
- Add a new layer of exercises focusing on a) diversity analysis; b) using BRAHMS online; and c) standardizing data regionally.
## 2 BRAHMS Advisory Group

BRAHMS Advisory Group members are responsible for setting software development priorities, providing general advice and feedback on system performance and, in some cases, are directly involved with system development. Advisory Group members are also guardians of the entire system (source code) and additional technical documentation that is not otherwise distributed. Each of the members has a considerable experience with BRAHMS and has made a substantial contribution to its development over the years.

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<td>Worked on Strobilanthes (Acanthaceae) of south-east Asia for his doctorate at the Department of Plant Sciences, University of Oxford. The taxonomic account was prepared using BRAHMS, and since then has been involved in coordinating the production of a manual for BRAHMS 5. He has now taken up a postdoctoral position at the University of Columbia to study the systematics and molecular evolution of Orobancheae.</td>
</tr>
<tr>
<td>Aljos Farjon</td>
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<td>In 1997, Aljos Farjon published the Flora Neoptopica account for Latin American Pinus using BRAHMS. His Pinus database was then expanded to include taxonomic details on all species of Conifer, this subsequently leading to the World Checklist of Conifers published by Kew. He is currently working on a revision of the Cupressaceae. He has contributed heavily to many of the taxonomic and nomenclatural features of BRAHMS.</td>
</tr>
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<td>Coordinator of the BRAHMS project and related software development. He is responsible for organizing BRAHMS training courses and is also involved with the development of regional database networks in Brazil, the Netherlands and South East Asia.</td>
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<td>Has been working with BRAHMS since 1994 and has coordinated the development of the main Kepong Herbarium database as well as promoting data exchange regionally. He has a special interest in conservation and analysis of the Flora in South East Asia, with a special interest in the Palms. He is also responsible for developing a new Botanic Garden in Kepong and as such, has a special interest in linking data from the herbarium with those of the Botanic Garden.</td>
</tr>
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<td>Has been working with BRAHMS since 1989 and has made contributions to most aspects of its functionality. He has used BRAHMS to assist with the preparation of his Leucaena monograph for Systematic Botany Monographs and is currently using the system to assist with the revision of Lupinus.</td>
</tr>
<tr>
<td>Andrew Liddell</td>
<td>Plant Sciences, University of Oxford - UK</td>
<td></td>
<td>Has been working on the development of internet components of BRAHMS. He has re-developed the main web site and is now involved with planning on-line database modules. One such example, already completed, is the on-line Bibliographic module for the National Herbarium on the Netherlands - Leiden branch.</td>
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</table>
Regina Martins da Silva, Curator, Herbário IAN Embrapa Amazônia Oriental - Brazil (regina@cpatu.embrapa.br).

Regina Martins da Silva has been coordinating the development of the BRAHMS database at one of the three largest herbaria in Amazonian Brazil (Herbário IAN, Belém) - including the incorporation of the Xylarium collections. She has promoted and strengthened relations between this herbarium and also the Museu Goeldi (MG) and Instituto Nacional de Pesquisas da Amazônia INPA in Belém and Manaus respectively.

Tim Pearce, Seed Conservation Department, RBG Kew - UK (T.Pearce@rbgkew.org.uk).

Tim Pearce started work with BRAHMS in 1995 at the EA Herbarium, Nairobi, Kenya. He has run several BRAHMS training courses in East Africa and has developed a database for the genus Kalanchoe. His new appointment as International Coordinator for Eastern Africa within Kew's Millennium Seed Bank Project also means he is advising on the development of the BRAHMS Seedbank module.

Jan Wieringa, Biosystematics Group, Wageningen University - Netherlands (Jan.Wieringa@wur.nl).

Jan Wieringa has been working with BRAHMS since 1999. During his PhD he developed a database for Aphanocalyx, Bikinia and Tetraberlinia. He has also been responsible for coordinating the development of BRAHMS for the ECOSYN research project, a study of plant biodiversity in West Africa. At present, he is scientific curator of the Wageningen Herbarium, and is involved in expanding their central database and using it for biodiversity assessment.

Luc Willemse, National Herbarium of the Netherlands, Leiden - Netherlands (willemse@hmpost.leidenuniv.nl).

Luc Willemse coordinates the development of the main databases of for the National Herbarium of the Netherlands which includes Leiden, Utrecht and Wageningen. He has been responsible for the large scale BRAHMS data entry program at Leiden, linking this with parallel database activities at U and WAG. He has also been responsible for the Netherlands Type digitisation programme, this including specimen image scanning, and in setting up the loans management modules of BRAHMS at Leiden. His current activities also include the coordination of the South East Asian Botanical Collection Network (SEABCIN).
3 Africa

3.1 Kenya

3.1.1 East African Herbarium

The East African Herbarium (EA) is the principal herbarium in Tropical East Africa and houses the largest collection from the region (c. 1 million specimens). A number of projects are underway either in or in association with the East African Herbarium and these are listed here.

Data compilation at the East African Herbarium (EA) was initially promoted through the DFID bilateral project entitled “East African Herbarium Plant Conservation & Propagation Unit” (1992-1999) [http://www.museums.or.ke/resherb.html](http://www.museums.or.ke/resherb.html) and continued with occasional support from RBG Kew staff and other visiting researchers.

Denis Filer made a number of DFID funded visits to this project, for example see:

- Establishment of an information system for botanical data at the East African Herbarium. A pilot study to collate data on the genus Acacia using BRAHMS. Report to DFID, October 1993.


Currently, some 20,000 specimens records are now available to Herbarium staff and users electronically through a central database. Focus has been on rare species, type collections and specialist datasets for taxonomic, conservation checklists and inventory projects.

3.1.2 East Africa Herbarium Types

An initial database of type specimens compiled by East Africa Herbarium staff in BRAHMS is supporting a partnership initiative between RBG Kew and regional herbaria to document and image type specimens for web-based delivery of specimen and name data.

3.1.3 The genus Kalanchoe

The genus Kalanchoe (specialist data): The project compiles specimen data from EA, The National Herbarium of Tanzania (NHT), University of Addis Ababa (ETH) and Kew (K). Preliminary conservation ratings are being produced and a conspectus series for each country to include recovery planning has been drafted. Draft database created by Tim Pearce (RBG Kew) is online on: [http://herbaria.plants.ox.ac.uk/bol/?kalanchoe](http://herbaria.plants.ox.ac.uk/bol/?kalanchoe).
3.1.4 The genus Aloe
The genus Aloe (specialist data): Collections from EA and K are being databased using BRAHMS to assist in a doctoral study by a member of EA staff, Ms. Emily Wabuyele.

3.1.5 Seed Collection guides (rare/threatened taxa)
With the inclusion of the East Africa Herbarium in the RBG Kew Millennium Seed Bank Project, 12,000 specimen records from over 800 endemic, endangered and economically important taxa have been compiled. These data are being fed into RBG Kew’s Millennium Seed Bank Project “Enhancement Grant” activities to produce collection guides for seed collecting teams over three seed conservation institutes in Kenya (see below).

3.1.6 Support to data management at the Genebank of Kenya
As part of the Millennium Seed Bank Project support to Kenya, training in the use of BRAHMS for the management of seed accession data has been initiated. Seed accession records from the project are held within a BRAHMS database. Further training proposed for 2005 will allow Genebank staff to fully evaluate the possible adoption of BRAHS for management of all accession data.
3.2 **Ethiopia**

BRAHMS work continues on the Flora of Ethiopia and also the Solanaceae by Prof. Ib Friis working from the Botanical Museum, Copenhagen in Denmark.

3.3 **Morocco**

At the University of Reading, the Moroccan collections are very well represented and BRAHMS has been used extensively for the E.U. project Floristic Biodiversity of Northern Morocco.

This work in Morocco is now being extended through a Darwin Initiative grant 'The Darwin Plant Information System for Morocco'. The project will produce a Flora and Red Data book information for conservation purposes and an on-line plant information system for Moroccan plant collections. This will allow Moroccan researchers easier access to plant data and help with the identification of specimens (through illustrations, photographs, and images). The project also aims to highlight areas and species for high priority action.

3.4 **Angola**

The project 'Leguminosae of Angola' is assembling data from all the collections of Leguminosae kept in two Portuguese herbaria COI (University of Coimbra) and LISC (Centro de Botânica) using the BRAHMS management system. The database will store information on Angolan legume specimens kept in COI and LISC. As a result of this project, it will be possible to make these data available to the Angolan Herbaria - and also to the scientific community worldwide.

3.5 **Malawi**

The BRAHMS project has a long standing relation to the National Tree Seed Centre, Zomba, Malawi. The work initiated under 'SISTEM+' has now been incorporated into BRAHMS.

A summary of the earlier work is provided in ‘Gondwe, D. and Mkandawire, M. (1996) Managing the Malawi National Tree Seed Centre Database-SISTEM+. FRIM Report No. 96005, Forestry Research Institute of Malawi, Zomba.’

Mr. Dominic Gondwe (National Tree Seed Centre Manager) from Malawi visited the Department of Plant Sciences, Oxford Forestry Institute in the United Kingdom in July 2002 with financial assistance from the Trapnell Fund. The main objective for the visit was to assist Denis Filer in further development of the seed bank module. Following this visit the BRAHMS database is currently installed in the NTSC replacing the SISTEM+ Seed Management Database. This brief report reviews the achievements made since the installation of BRAHMS database, further developments required and regional opportunities.

A summary of the Malawi National Tree Seed Centre follows:

The Malawi National Tree Seed Centre (NTSC) is mandated to supply tree seed of high genetic and physiological quality for all afforestation programmes in Malawi. Various activities are undertaken to accomplish this objective including seed collection, processing, testing, storage and distribution. Demand for tree seed before 1980 was mostly on exotics particularly eucalypts and pines for the expansion of Government plantations and tea and tobacco estates. This indicates that the NTSC handled very few seedlots. Hence seed records regarding information on
seed collection, processing, testing, storage and distribution were successfully kept on index cards. However, around 1980s tree seed demand diversified to include indigenous tree species for social forestry and agroforestry as well as for the rehabilitation of the degraded areas. Thus the NTSC managed a lot of species and/or seed lots to meet the nation’s needs. In this regard the index card system was no longer efficient and, as such, led to several management problems. For instance it was very slow and time consuming to produce reports on stock levels by species or customer information. Further, cards could be misplaced thereby delaying customer services, as it required more time to go through a bunch of cards before a customer’s query was addressed.

3.6 Benin

The Flore du Benin project. This project is writing a key with short descriptions for all plants of Benin. An enormous amount of new material has been collected for this project, and this data is now assembled in BRAHMS.

3.7 Liberia

Records from the herbarium database in Wageningen (WAG) for Liberia have been provided already twice to Conservation International. This is relating to a project trying to restore nature conservation in Liberia post civil war. Their assessment of botanical values of regions in Liberia is entirely based on these data gathered by BRAHMS.

3.8 Central African Republic

Complete checklist for Dzanga-Sangha NP published by D.J. Harris, RBG Edinburgh.

3.9 Cameroon

BRAHMS is installed at the Limbe Botanic Garden and also in Yaunde. Current feedback limited.

Mount Cameroon Checklist published directly from BRAHMS.

A training course run by Denis Filer at Limbe, 2001
3.10 Gabon

The following information was provided by Jan Wieringa, Wageningen, Netherlands.

The Biodiversité Botanique du Gabon is a 5 year project funded by the Dutch development agency, DGIS. In this project the National Herbarium of Gabon has been further developed. The entire collection is now being digitized into BRAHMS. This database will assist the herbarium in its role as the National Expertise Centre for Botanical Information.

The project has supported and partly run the work needed prior to the creation of 13 new National Parcs in Gabon in 2002 (more than 10% of the country surface). The botanical richness of these areas will now be further accessed with help from BRAHMS. Not only does the entire herbarium administration of Gabon nowadays depend on BRAHMS – the system has also created the opportunity to compare identifications with duplicates at other herbaria, mainly Wageningen, thus updating the local Gabon collections. This has improved the identification states of the material enormously.

Checklist of Gabon project. We prepare a checklist of all known plant species of Gabon using Brahms. The checklist will be based on all collections ever made in Gabon. BRAHMS is used to add in additional data and the final checklist will be derived from BRAHMS. Thanks to BRAHMS we will be able to produce regular updates of the checklist without to many efforts.

The Gabon checklist project will be followed by a Gabon wide biodiversity assessment, performed by BRAHMS. Very important for future conservation efforts.

3.11 East Tropical Africa (general)

There is much potential to bring together data from the herbaria in Tropical East Africa along the lines of the South East Asian Botanical Collections Information Network (SEABCIN) project discussed in this document, possibly under the umbrella of existing regional initiatives or proposed initiatives including the Botanical and Zoological Taxonomic Networks in Eastern Africa (BOZONET). Such a project would encompass institutions in Ethiopia, Kenya, Somalia, Tanzania and Uganda.

3.12 West Tropical Africa (general)

The ECOSYN project, based at Wageningen, Netherlands has been preparing field guides, ecological atlas and profiles of trees and lianas of West Africa, Guinea to Ghana, to support ecological management of its forests. For this project, some 60,000 specimens of West African plants were added to BRAHMS. With this information a biodiversity analysis has been performed (partially in BRAHMS, partially in ArcView), 300 species maps have been prepared, 300 plant descriptions and ecological profiles where prepared and edited in BRAHMS. This work was published in:


The ECOSYN project is also producing a field guide to identify all woody forest plants of the forests from Senegal to Togo. The writing itself is not performed in BRAHMS but the authors rely heavily on BRAHMS to monitor identifications and quickly map species distributions.

Diversity data calculated in BRAHMS by looking at the number of collections per geographic cell and weighting the cell content by checking which other cells the species in each cell occur in.
4 ASIA-TROPICAL

4.1 India

Flora of India projects. Much BRAHMS email communication and downloading. Apparently BRAHMS is being widely used for Flora of India Project including in the Calcutta herbarium (latest report from Tim Pearce, RBG Kew). However no direct feedback or information available.

4.2 Macro-fungi of Karnataka

This is a new (Sept 2004) and small project to help identify large fungi in an area of Karnataka. Preliminary results are on http://herbaria.plants.ox.ac.uk/bol/?kodagu. Contact: Dr Shonil Bhagwat, Biogeography & Conservation Lab, The Natural History Museum, Cromwell Road, London. E-mail: S.Bhagwat@nhm.ac.uk

4.3 Laos

New BRAHMS herbarium project starting 2004. Contact Paul Kessler Kessler@nhn.leidenuniv.nl

4.4 Thailand

The Forest Herbarium (BKF) undertakes research on plant and fungal taxonomy, forest ecology, ethnobotany and conservation biology. BKF is linked to the SEABCIN project.

4.5 SEABCIN Project

The SEABCIN project (South East Asian Collection Information Network), developed by the Leiden Herbarium and the BRAHMS Project, was funded by Asia IT&C, a European Community funding agency promoting links between Europe and Asia.

The ambitious aim of the project has been to bring together collection data from all the main herbaria in S.E. Asia with that of Leiden in the Netherlands to produce an online data consultative system. The Leiden Herbarium has long historical links to S.E. Asia and most of its collections are from that area. It has resulted in an online database linking databases in Indonesia, Netherlands, Malaysia, Philippines, Singapore and Thailand.

Singapore is not funded under the SEABCIN Project but has agreed to participate.

The pilot phase of this project was completed October 2004, fulfilling three key project developments:

a) Development of BRAHMS online.

b) Standardization of data across the region

c) Gathering of data on a pre-selected number of genera.
4.6  Indonesia

4.6.1  Bogor

The Bogor herbarium (BO) is the largest herbarium in South East Asia (next comes Singapore). Bogor is a partner in the SEABCIN Project and procedures are in place to link data from the Bogor in-house database to BRAHMS.

Communications with Bogor, much of this via Leiden, have not been easy. Nevertheless, some progress has been made recently (2nd half of 2004). There is scope to strengthen these links but this depends on interest in collaboration from Bogor management.

4.6.2  Kalimantan, Indonesia

The Wanariset herbarium, the largest single collection in East Kalimantan has all its collections in a BRAHMS database. This was published from BRAHMS in:

The introduction to this publication follows:

INTRODUCTION

The Herbarium Wanariset, Samboja (WAN), houses the largest collections of plants inside Kalimantan, Indonesia. Due to joint efforts of the Indonesian Ministry of Forestry and Estate Crops implemented by its Forest Research Institute Samarinda and the Tropenbos Foundation of the Netherlands, it was possible to establish a place to deposit and manage botanical specimens properly and at the same time carry out taxonomical, floristic and ecological research.

The very base for a sound knowledge of a country's flora is a thorough inventory of the area. Due to exchange programs with various other national and international institutes and individuals and our own expeditions our collection has reached more than 11,000 specimens since its foundation in 1989. Our main interest being a forestry project is of course the tree flora of Kalimantan, but we house also smaller collections of plants outside Kalimantan, i.e. Java, Sulawesi, Sumatra, and Irian Jaya.

Recently the whole collection was entered into the 'BRAHMS' (Botanical Research and Herbarium Management System) database and all individual sheet provided with barcode labels. In future we will try to scan all herbarium material and link it directly to the database which will eventually become available to the scientific community via WebPages on the Internet.

The presence of high botanical diversity in the natural forests of Kalimantan is reflected in our collections. Now it is nationally and internationally recognized that one has to strive to an acceptable balance between development and conservation of natural resources. It is therefore imperative to carry out up-to-date botanical inventories in order to provide data on the availability, distribution, ecological and conservation requirements, and economic potential of the plant resources. Without such information it will be impossible to develop and manage natural resources on a sustained base.

4.6.3 Sulawesi - Indonesia


4.7 Malaysia

Much of the following information was provided by Saw Leng Guan, Curator of the Kepong Herbarium, KL, Malaysia.

4.7.1 Tree Flora of Sabah and Sarawak

The Tree Flora of Sabah and Sarawak aims to document the tree species of states of Sabah and Sarawak, Malaysia on the island of Borneo. The floristic work will document about 3,500 tree species and has plans for a publication of 8 volumes. Four volumes have already been published.

This year volume 5 will be published. BRAHMS has been used extensively to track and document the specimen information in the families revised. The database for the Bornean collection now stands at 65,850 entries.
4.7.2 Plant geography and conservation of Peninsular Malaysia flora
This project uses data from mainly herbarium collections with geo-reference information (longitude and latitude points) of some selected plant families including the Dipterocarpaceae and Palmae. Patterns of distribution are then described from the species. These patterns are correlated to topography and other regional zones. The phyto-geographical zones are used for identification of Important Plant Areas of Peninsular Malaysia and further developed towards plant conservation.

Two examples of narrowly restricted, commercially important tree species found on the Malay Peninsula. Maps drawn from BRAHMS.

4.7.3 Fruit trees of Peninsular Malaysia
The project documents the wild fruit tree relative found in Peninsular Malaysia. BRAHMS is used for data gathering and provides maps for distribution patterns of the wild relative of fruit tree species.

4.7.4 Conservation Status of Threatened Plants of Peninsular Malaysia
The project assesses the conservation status of mainly Peninsular Malaysian endemic plant species using IUCN threat categories and criteria. BRAHMS is used for herbarium data management and extensively used to plot out distribution maps so as to aid the assessment.

Photo of a limestone hill (Bukit Takun) in the Malay Peninsula, a habitat with very high endemism.
4.7.5 Checklist of Vascular Plants of Krau Wildlife Reserve

A checklist of over 1,000 species of vascular plants has been compiled as part of the management plan of the Krau Wildlife Reserve. Information on these species has been stored in BRAHMS and subsequently the report was generated from BRAHMS.

4.7.6 Floristic Revisions in Malaysia

a) Licuala (Palmae) of Borneo Project

The floristic project revises the genus Licuala of Borneo. This revision covers over 45 species. BRAHMS has been used for specimen tracking and also for nomenclatural information management.

b) Tiliaceae monograph for Flora Malesiana Project

Revision of the family Tiliaceae for the Flora Malesiana project. BRAHMS is used for specimen database platform the monographic work and taxonomic information work.

c) Escalloniaceae monograph for Flora Malesiana Project

As for Tiliaceae.

4.8 Singapore Botanic Garden

The herbarium of Singapore Botanic Garden have been using BRAHMS for about 5 years. They have completed a register of type collections with digital images and are continuing database this historically important herbarium. Although not itself a DFID target country, the work being undertaken in Singapore (2nd largest herbarium in S.E. Asia) will benefit the regional generally. The early BRAHMS work at the Singapore herbarium was described in Kiew, W., Khin, N.N. and Filer, D.L. (2001). Implementing BRAHMS at the Singapore Herbarium. Newsletter of the Singapore Botanic Gardens 16: 15-17.
4.9 Philippine National Herbarium

The Philippine National Herbarium (PNH) database is linked to SEABCIN project and runs a BRAHMS database. More information will be available after the SEABCIN workshop to be held in Leiden 18-22 October 2004. The curator is Dr Domingo Madulid.
Denis Filer presenting a BRAHMS course certificate to Dr Domingo Madulid, Curator of the National Herbarium of the Philippines (PNH) after a one week SEABCIN workshop held in Kuala Lumpur, Malaysia, October 2003.

The course coordinator Saw Leng Guan, curator the of FRIM herbarium at Kepong, convening.
5 EUROPE

5.1 Baltic States
There are BRAHMS projects ongoing in both Lithuania and Estonia. Feedback had been requested but no response for about 9 months.

5.2 Germany
Senckenberg-Herbarium Frankfurt has an active BRAHMS herbarium database. Contact Wolfhardt Widdra, widdra.wolfhardt@gmx.de

5.3 Netherlands

5.3.1 Leiden
Leiden is the largest herbarium in the Netherlands and one of the largest worldwide with c. 4 million collections. The herbarium has been using BRAHMS for roughly 7 years. The system is used for overall curation and lies behind their virtual herbarium, soon to be transferred to BRAHMS online. Leiden employs a number of full-time technical staff to enter species and specimen data into BRAHMS. The BRAHMS Project coordinator in Leiden is Luc Willemse – also a member of the BRAHMS Advisory Group.

The geographic focus of the Leiden herbarium is the Malesian region and they coordinate the publication of the Flora Malesiana.

Leiden also coordinating the recently completed SEABCIN Project, promoting collaboration between Europe and the herbaria of S.E. Asia.

5.3.2 Utrecht
Utrecht operate a BRAHMS database, similar to that of Leiden – although it is a smaller herbarium. The geographic focus of Utrecht is South America.

5.3.3 Vadense herbarium Wageningen, Netherlands

Text provided by Jan Wieringa, Wageningen.

The past ten years we have been working on the electronic accessibility of our collections. For this purpose our collections have been entered in a BRAHMS database. Using BRAHMS we administrate all curation tasks. Next to curation, our database is a powerful research tool for e.g. biodiversity assessments and preparing checklists. We also use this database to distribute the knowledge kept in our herbarium over the world. All types in our collection have already been entered in the database and include also a digital photo of the sheet. These collections, including their photo's, together with a selection of other databased collections from the Leiden, Utrecht and Wageningen herbaria can be consulted in our virtual herbarium. In addition the complete databases of Wageningen and Leiden are available on the internet as one of the database groups presented by Brahms Online. The later internet database is still under construction and its options and content are changing regularly; at present not all fields can be consulted, while only a few images are linked to the collections.
Most digitised collections concern plants from Gabon; together with Missouri Botanical Garden we strive to have databased within a year all collections from Gabon that are available worldwide. The top ten of collections per country present in our database after Gabon (ranking high to low) is: Ivory Coast, Cameroon, Benin, Liberia, Ghana, Nigeria, Congo (Kinshasa), Sierra Leone, Madagascar and The Netherlands.

Several African botanists per year come to Wageningen for one to several months to receive a practical training in plant systematics. Part of their training is also to learn to work with Brahms to handle their herbarium specimens and to site them in a publication, to produce distribution maps, to calculate phenology, etc.

The PhD projects of Ali Sattarian (Iran) and Thomas Couvreur (Belgium) lean heavily on BRAHMS for their research activities.

5.3.4 National herbarium of the Netherlands

The combined data for Leiden, Utrecht and Wageningen are available on BRAHMS online.

5.3.5 Leiden Library online

Leiden have entered their entire Botany Library holding into the BRAHMS Biblio module – specialist area South East Asian Botany. This is available online. The Leiden Library database is about to be incorporated into the new BRAHMS online Biblio module funded by FRP.
Sample search on titles of books and/or references including the word ‘mangrove’.

5.4 Denmark
Ethiopian Flora Project, Dr Ib Friss, Botanical Museum, University of Copenhagen. (email ibf@bot.ku.dk)

5.5 UK
5.5.1 BRAHMS development
BRAHMS development was originally carried out based within the Oxford Forestry Institute but this now ‘incorporated’ into the Department of Plant Sciences. The BRAHMS Project is physically located within the Daubeny herbarium FHO - previously the Forest Herbarium, part of the Oxford University Herbaria.

5.5.2 Oxford University Herbaria
The Oxford University Herbaria are located in the Department of Plant Sciences, University of Oxford. The history of the Herbaria is closely linked with that of the Oxford University Botanic Garden. The Herbaria were found in 1621 and are the oldest in the UK. The Oxford University Herbaria comprise two separate herbaria: the Fielding-Druce Herbarium (OXF) and the Daubeny Herbarium (FHO). In addition, there is also a xylarium (FHOw).

The total collection comprises approximately 800,000 specimens from all taxonomic groups and regions of the world. The collections are particularly rich in British, New World, African and Australian material. In addition, there are extensive collections made before 1796, including the herbaria of Morison, Bobart, Sherard, Dillenius, du Bois and Sibthorp. The Herbaria are very rich in types.
Specimen data and images, literature, illustrations and manuscripts (including letters and autographs) from OXF and FHO are gradually being added into a central BRAHMS database. The current database has been created from existing data sets. The only comprehensive data set is that for the Mimosoid legumes in OXF. Given the size of the Herbaria, the focus of the digitisation programme will be Type material. This database will be regularly updated and is available here for consultation. All of the specimens, except historical material, is available for loan according to our standard conditions.

5.5.3 Pinus monograph


Mexico has by area the greatest diversity with 42 species and 18 infraspecific taxa, followed by China with 22 species and 6 infraspecific taxa and California (USA) with 17 species and 3 infraspecific taxa. Other centres are in the SE United States, the Mediterranean and SE Europe. The ecological diversity is great: from the Arctic tundra/taiga ecotone in the north to tropical pine savannas in the south and from dry foothills bordering the hot deserts of America up to the

Oxford University Herbaria on BRAHMS online at http://herbaria.plants.ox.ac.uk/bol/?oxford.
snowline on the highest mountains. Consequently, the habit of pines ranges from low shrubs to among the tallest trees in the world.

Economically, Pinus is probably the most important tree genus in the world. Particularly in Mexico and Central America, a sound and widespread knowledge of species is of the utmost importance to make a better and wiser use of their forestry potentials and to protect rare and interesting species. The importance of a taxonomically sound reference work, with identification keys and descriptions, to assist in the interpretation of specimen data in this database, is evident. The Flora Neotropica Monograph cited above provides all the additional information needed for this purpose. Field identification has been made easier by the publication of a field guide (Farjon, A., Pérez de la Rosa, J. A. & Styles, B. T. 1997, Guía de campo de los pinos de México y América Central. Royal Botanic Gardens, Kew, also available in English) based on the Monograph and the information stored in this database.

The monograph of Pinus by Aljos Farjon was published in Flora Neotropica Volume 75, 1997 and is available on BRAHMS online http://herbaria.plants.ox.ac.uk/bol/?pinus.

5.5.4 The genus Inga

Approximately 50% of species are confined to rain forest on non-flooded land, while the remaining 50% occur in riparian situations, on periodically flooded land and in disturbed vegetation. Although most abundant in non-seasonal climates, they also extend into seasonally dry areas, such as Pacific coastal Ecuador. In arid zones they are restricted to a few species along periodic water-courses.

The genus Inga (Leguminosae: Mimosoideae: Ingeae) comprises 258 described species of trees restricted to tropical America. It is a ubiquitous component of lowland and montane rain forest throughout the humid tropical zone from 24 degrees north in Mexico to 34 degrees south in Uruguay. The highest species diversity is concentrated in the Andean foothills of Peru, Ecuador, Colombia and in southern Central America., and within this area it occupies a wide variety of habitats from sea level to 3000m altitude.
Inga has been utilized by man for its edible fruit for several thousand years and today it is still an important item of local commerce throughout the Andean countries, Central America and lowland South America.

Over the centuries selected forms of certain species have been protected and cultivated, so that they are now recognizable as distinct cultivars, which have been carried far from their centre of origin. Inga species also have a long history of utilization as shade trees, originally used by pre-Colombian inhabitants of Peru as shade for coca bushes, and since the mid-nineteenth century as shade for coffee, cacao and tea. Throughout Andean South America, many thousands of hectares of these crops still depend on Inga, not only for their shade but also for the leaf mulch, which provides weed control and nutrients, for their nitrogen fixing properties and for fuelwood from their periodic pruning.

More recently, Inga has been recognized as one of the few legumes in tropical America which will survive and flourish on the impoverished acidic red soils which cover much of the land surface of the region, and much research effort is now focused on the restoration of these soils which support much farming activity after the cutting of rain forest. It is now recognized that Inga has an important role in agroforestry systems which are designed to bring back degraded acid soils into productive use, and Inga species are being prioritized by the International Centre for Research in Agroforestry (ICRAF) working in Amazonian Peru.

The genus Inga has been published online on http://herbaria.plants.ox.ac.uk/bol/?inga.

### 5.5.5 African Acacia projects

Support provided to a series of projects on African Acacia coordinated c.1990 - 2004 by Richard Barnes. The African Acacia database includes comprehensive collections and species data for the genus in Africa. Database created by Chris Fagg still operational and to be used to produce further outputs. Several publications have been derived from or partly from the database, many of these including species distribution maps.

### 5.5.6 Central American forest genetic resources activities

The BRAHMS project has provided support to all the DFID funded Central American forest genetic resources activities including work on Leucaena, Parkinsonia, Gliricidia, Albizia, Calliandra, Acacia and other general legume collections.

Specimen data were stored and used to produce a range of outputs from basic documentation labels and lists to various categories of analyses and maps. Voucher data for seed collections were also managed. At this time, the seed data themselves were stored separately in SISTEM+.

### 5.5.7 The genus Leucaena

The early development of BRAHMS was always closely associated to work on the FRP funded Leucaena carried out by Colin Hughes. The Leucaena work encompassed a broad activity including monographic research and a study of its multi-purpose tree potential.

The greatest diversity of species is in Mexico (17 species, 10 endemics) and northern Central America (9 species, 4 endemics). The genus extends north into southern Texas, U.S.A., sporadically across the Caribbean and into South America, as far south as Peru. All species are small to medium-sized trees which grow mainly in seasonally-dry deciduous tropical forest.

The economic importance and domestication of Leucaena species, and particularly L. leucocephala for the production of livestock fodder, green manure, small wood products and for soil conservation is well-known and widely documented. Leucaena species are now cultivated pantropically as forage and wood crops. In Mexico, 13 species of Leucaena are used as minor food plants and have undergone a complex process of indigenous domestication.

A Genetic Resources Handbook (Hughes, C.E. 1997. Tropical Forestry Paper 37, Oxford Forestry Institute) has been written to document these economically important genetic resources. Data and descriptive text covering main species attributes, botanical features and full botanical descriptions, tree size and form, taxonomy, species distributions, ecogeography, conservation status, utilisation, weediness, and chromosome numbers, have also been incorporated within the BRAHMS Leucaena Monograph.

The Leucaena monograph was published in Systematic Botany Monographs Volume 55, 1998 and the database is online on http://herbaria.plants.ox.ac.uk/bol/?leucaena.
5.5.8 The genus Agathis

Agathis is a genus of tropical conifers which belongs to the Araucariaceae, the same family as the monkey-puzzles and Cook-pines (Araucaria) and the Wollemi Pine (Wollemia). Agathis trees are usually huge trees of lowland rain forests, though some grow in mossy forests on mountain tops, and others as low candelabra-like forms in low scrubland. The genus is distributed from Malaysia, Brunei and Indonesia, through New Guinea, Queensland and the eastern Solomons, to Vanuatu, New Caledonia, Fiji and New Zealand.

The genus is especially valuable for two reasons: firstly, its beautiful, high value timber, and secondly its valuable resin which is still used for many varnishes and lacquers. It is also a particularly challenging genus to understand taxonomically. Most herbarium specimens are sterile, the nomenclature is famously confused, there is very little morphological variation between the species and next to nothing is known about the phylogeny of the genus. The data are managed by BRAHMS.

The Agathis website has been published on http://herbaria.plants.ox.ac.uk/bol/?agathis

5.5.9 The genus Schefflera - Araliaceae

This large genus is being revised by David Frodin, until recently working from RBG Kew. His BRAHMS database, based on a decade of work, includes c.14,000 collections records together with details on all species names.

*Schefflera actinophylla*, (octopus or umbrella tree), native to and common in Australia.
5.5.10 Lupinus database

Text provided by Colin Hughes, Department of Plant Sciences, Oxford

The ubiquitous familiarity of the common garden lupin provides little hint of the tremendous diversity of lupin species, the intractable confusion surrounding their taxonomy, or their true economic importance. The legume genus Lupinus is rich in species, widely distributed in the New and Old Worlds and of diverse economic importance in agriculture as well as horticulture. Lupins have been cultivated since antiquity as an edible pulse, animal fodder and green manure. Two Mediterranean and one Andean species have been domesticated in parallel over several millennia as indigenous food plants. Along with other 'lost crops of the Incas', seeds of Lupinus mutabilis remain an important component of the highland Indian diet throughout the Andes. Lupins derived from these indigenous domesticates and other closely related species are also cultivated on a large scale in commercial agriculture, with up to 1.5 million tones of lupin seed produced per annum in Australia alone. The wider horticultural potential of the genus remains largely untapped.

A BRAHMS database of Lupinus forms part of the revisional work being undertaken on this genus by Colin Hughes at Oxford Plant Sciences Department with the Oxford University Herbaria.

5.5.11 RBG Kew enhancement activities – specimen capture

The Millennium Seed Bank Project is an international collaborative plant conservation initiative. This worldwide effort aims to safeguard 24,000 plant species from around the globe against extinction. It has already successfully secured the future of virtually all the UK's native flowering plants. During 2004, the project selected BRAHMS to capture data from specimens in the main Kew herbarium for Endangered, Endemic and Economically important species. The target is to process c.100,000 specimens over a 3 year period. These data are being used to prepare species level information sheets. Coordinated by Sharon Balding, RBG Kew.

The Millennium Seed Bank Project is housed in the Wellcome Trust Millennium Building, located at Wakehurst Place in West Sussex. The project is staffed by the Seed Conservation Department of the Royal Botanic Gardens, Kew. (data taken from RBG Kew website).

5.5.12 RBG Kew enhancement activities – collection guides

The major output of the above exercise is the repatriation of specimen data and specimen images in the form of “Collection Guides” for seed collection teams in partner countries (see above Kenya). In addition, preliminary conservation ratings will be given to all taxa covered. Specimen
data from partner herbaria are frequently augmented with the collections data from K thus giving an authoritative account of species distribution, identification and phenology.

5.5.13 RBG Kew enhancement activities – taxon database
In order to enhance the value of the seed collections held by Partners in the Millennium Seed Bank Project, species data for those taxa currently held (with the emphasis on those species of conservation importance) are being compiled. This will be complementary to the exhaustive accession data already managed by the Millennium Seed Bank.

5.5.14 Revision of the genus Abelia (Caprifoliaceae)
Project started by Sven Landrein 2004. Abelia is a popular horticultural plant in popular in Europe and Asia.

5.5.15 Revision of the genus Caltha (Ranunculaceae)
Project started by Sharon McDonald 2004. Abelia is a popular horticultural plant in popular in Europe and Asia.

5.5.16 World Conifer Checklist
Now in its second edition, the World Conifer Checklist by A. Farjon, RBG Kew includes a complete account of all conifer names. This list is effectively a taxonomic conspectus of all the conifer names including synonyms. The checklist is stored in and was largely generated from a BRAHMS database. Probably the single largest publication produced from BRAHMS.

5.5.17 Cupressaceae Monograph
This monographic work by A. Farjon, RBG Kew (in press October 2004) includes the following acknowledgement.

“The taxonomic treatments, species descriptions, specimen lists, maps and various summaries and indexes in this work were prepared with assistance from BRAHMS, a key function of which is to assist the monographer. It has brought together taxon names (with their authors, protologue citations, synonyms, types and descriptive text) and fully geo-referenced specimen data into an integrated system. Input of data into BRAHMS commenced in 1996; for specimen data with the highly appreciated help of Peter Edwards at Kew. Throughout, the evolving database has provided both a framework to store and edit data and an invaluable perspective contributing to the resolution of nomenclature, in particular synonymy and typification and the gradual process of
building and formatting the final product prior to dispatching files to a Word document. Checklists, synopses, floras, revisions and monographic accounts can be seen as a continuum, going from the simple to more complex - all produced from the same source. The BRAHMS database used to produce this particular publication can now be easily manipulated to produce further products for curation, research or products intended for a wider distribution.

As well as the complete nomenclatural update on this economically important plant group, the database includes IUCN codes and criteria, text notes on conservation and comprehensive data on geographic distribution. The use of the TDWG (Taxonomic Databases Working Group) geographic coding in BRAHMS means that the database, as well as being used for species mapping, can be consulted with questions such as ‘List all conifers of China that are threatened’ or ‘list all conifers endangered in Mexico’.

A sample screen from the Cupressaceae database showing the entry of text data in the main species list. Users can define their own specialized storage fields adding to the BRAHMS core fields. Here, notes are being added for Conservation, Ecology and Uses. These data, added for all species in the database, are subsequently formatted in the species accounts.

5.5.18 RBG Kew Kamchatka database
Database for the Kamchatka peninsula in the Russian Far East developed by R.K. Brummitt and A. Farjon.

5.5.19 Reading University
The University of Reading Herbarium (RNG) has been using BRAHMS since 1990. They currently hold over 20,000 collections in the main database. This includes angiosperms, pteridophytes, bryophytes and lichens. The main geographical range of the collections is Europe, especially Great Britain and Ireland, the Iberian Peninsula, North Africa (especially Morocco),
Macaronesia, the Middle East, cool temperate South America; pteridophytes and bryophytes worldwide; lichens, the British Isles, Europe and Morocco.

Further details including online searching of the collections can be found at http://www.herbarium.reading.ac.uk/

For information about the BRAHMS database at RNG, refer to http://www.herbarium.reading.ac.uk/brahms/

5.6 Portugal

Databases at Lisboa (LISC) and Coimbra. Awaiting feedback for this document.
6 North-South America and Caribbean

6.1 Brazil

6.1.1 Embrapa Amazonia Oriental
Site of IAN herbarium with c.170,000 specimens, 99% databased in BRAHMS. Most active proponent of herbarium database development in Amazonian Brazil and the first to make extensive use of digital images.

The EMBRAPA Herbarium has been developed as a model for other herbaria in the Amazon region, Brazil generally and potentially other countries. The scale, width and breadth of the herbarium database is an indicator of the vitality of the herbarium in general. The EMBRAPA herbarium has excellent facilities and management structure, hugely useful botanical collections, active research sub-groups, is highly motivated and has strong practical links to applied research activity (forest management, field guild production, the provision of species information, and more). It has the vision to bring together different data components into a central system (herbarium specimens, xylarium, fruit collections, images and more). Various innovative database activities are ongoing, much of this based on the work with images. There is also now the opportunity for EMBRAPA to accelerate further ahead by publishing on the internet using BRAHMS online.

Database progress at EMBRAPA has been noted nationally and internationally at various congresses. There is a sense of surprise that they have managed to complete entry of entire herbarium collections as an example a May 2004 communication from Tim Killeen, Senior Scientist with Conservation International:

“As part of our efforts to create regional networks dedicated to biodiversity, I have been speaking with a number of botanists in Brazil and the Andes and it would seem that BRAHMS had being widely adopted by latin American institutions, particularly in Brazil, where information from several hundred thousand specimens seem to have been captured by herbaria using BRAHMS. Could it possibly be true! Congratulations!”

The collaborative links, funded by DFID, between EMBRAPA and the BRAHMS Project in Oxford have been fruitful. Much of the success of this can be attributed to the planning, organization and vision of the herbarium curator Regina Silva and her staff. These staff have in turn have trained others to a high level of competency and confidence. The arrival of Mike Hopkins and the Sapeca...
team, again supported by Dendrogene, has been a great boost and stimulation to this work, especially with the imaging work.

Many posters and presentations have been prepared and numerous regional training courses have been and continue to be run by Embrapa herbarium staff in Amazonia and elsewhere in Brazil. One of the first presentation given was ‘A DATABASE OF PLANT BIODIVERSITY FROM BRAZILIAN AMAZONIA, Regina Martins-Da-Silva (IAN Herbarium, Brazil), Ricardo Secco, Denis Filer, Gracialda Ferreira. XVI International Botanical Congress, August 1999 Saint Louis, Missouri.

6.1.2 National Brazil Botanical Congress 2003

BRAHMS is used widely in Brazil and after the 2003 National Botanical Congress held in Belém, the Brazil Botanical Society recommended that it be adopted as a country standard.

Denis Filer was an invited speaker at that congress: “Filer, D.L. (2003). Maximizando a utilidade dos bancos de dados de herbaríos (Optimizing the value of herbarium databases). Invited presentation at the Brazil National Botany Congress, July 2003, Belém, Pará, Brazil.”

6.1.3 Museu Goeldi (MPEG)

http://www.museu-goeldi.br/

The Museu Paraense Emílio Goeldi is a key Brazil Government Museum and research institution under the Ministry of Science and Technology, located in the city of Belém, Pará. Since its foundation in 1866, its activities are concentrated in the scientific study of the natural and sociocultural systems of the Amazônia, as well as in the spreading of knowledge and quantities related to the region.

The museum is the site of MG herbarium with c.200,000 specimens, 90% databased in BRAHMS. This project has been running for about 8 years coordinated by the herbarium curator Ricardo Secco. Close links have been forged between the BRAHMS projects at MPEG and Embrapa.

6.1.4 Instituto Nacional de Pesquisas da Amazonia (INPA)

Site of the INPA herbarium with c.210,000 specimens, 70% databased in BRAHMS. Several training courses have been run at INPA by Denis Filer and staff from Embrapa. INPA staff have also been to Embrapa for training.

http://www.inpa.gov.br/

6.1.5 Other smaller Amazonian herbaria in Brazil

HAMAB, HUAM, ORSA Florestal, PRANCE, UFAC, UFMT, UFPA (Bragança and Santarém) have recently started BRAHMS projects. Of these, the HAMAB herbarium in Macapá, Amapá is the most advanced and has c.10,000 collections, already databased in BRAHMS.

6.1.6 University of Brasilia – UB herbarium

BRAHMS has been in use for c. 3 years for general herbarium curation, the Flora of the DF region and in a number of small research projects including a monograph of Pleonotoma.
(Bignoniaceae).

6.1.7 Other herbaria in Brazil

BRAHMS is being used fairly extensively in Brazil. It is difficult to know exactly where and what progress is being made. However, there are at least 20 further projects, some sizeable. Over the years, outside the Amazon region, training courses have been given in the North East of Brazil, Brasilia, Rio de Janeiro. The website software is regularly downloaded by many of these projects.

In Rio de Janeiro, projects have been initiated at the Jardim Botanico, the Museu Nacional and the Herbario Bradeanum, all important for botanical study in Brazil. Most of the Portuguese manual translation work was undertaken in Recife, North East Brazil.

6.2 Puerto Rico

Brahms is being used extensively in the MAPR Herbarium, Puerto Rico. The curator is Jeanine Vélez Gavilán. With the support from their Biology Department and some federal agencies they have entered c. 27,000 collections from the MAPR herbarium and other major herbaria in Puerto Rico, United States and Europe.

BRAHMS is also now being used at the UPRRP Herbaria which together with MAPR, covers the entire island.

This is important as most of the collections from PR are poorly known - many are of important historical collections. Having all this information in one database will help us to assess our very threatened flora.

For being able to expand the project goals, MAPR are raising funds to:

- Improve their BRAHMS database.
- Geo-reference the specimen localities.
- Help in training undergraduate and graduate students in activities related to plant taxonomy.
- Publication of MAPR Herbarium on-line – to include details on 14 conservation critical regions

Apart from the general curatorial work, BRAHMS is being used for research to publish floras of various reserves in PR and also in research of the distribution of rare and endangered species. This research work is funded through the International Institute of Tropical Taxonomy and the US Fish and Wildlife Service, respectively.

6.3 Trinidad-Tobago

Darwin Initiative application submitted October 2004 includes BRAHMS implementation.

6.4 Honduras

The Paul C. Standley herbarium (EAP), located at the Escuela Agricultura Panamericana, El Zamorana in Honduras, was the first project to adopt BRAHMS outside the Oxford Forestry Institute.

The EAP herbarium, after going through a period of change and redirection, are continuing their work with BRAHMS and it hoped, will play an important role in helping to establish a Central American database network.
They are currently in a project with INBio with backing of the government of Norway. Data from c.7,000 sheets per month are now being added to BRAHMS. The project coordinator at EAP is George Pilz.

6.5 Panamá

The Smithsonian Tropical Research Institute (STRI) in Panama, the only bureau of the Smithsonian Institute based outside of the United States, is dedicated to understanding biological diversity. Mireya Correa or STRI is coordinating BRAHMS work in Panama. BRAHMS is being used at both herbaria in Panama (SCZ and PMA). In SCZ, almost 50% of the herbarium collections have been processed into BRAHMS. These data are being used to prepare the Flora of Panama. Panama have requested a BRAHMS training course early 2005.

6.6 Chile

Projects to be initiated in 2005 for Seed Bank and Herbarium management though INIA. Denis Filer visited Chile in March 2004 for 2 days (from Brazil) to introduce BRAHMS and review project options. This brief visit was funded by the Millennium Seed bank project.

6.7 Bolivia

Information provided by the Bolivian Darwin Initiative Project leader John Wood:

The Darwin Initiative Project “Plant Endemism in the Dry Valleys of Bolivia” uses BRAHMS as its system for data basing plant collections in the four Bolivian Herbaria with which we work and training in the use of Brahms is an important part of the training of our Bolivian staff. We find it an essential tool for linking data with photographs and site information in order to identify hotspots of endemism with a view to their conservation. The project makes use of this data to promote conservation and eventually to empower local communities to understand and take responsibility for the conservation and sustainable use of natural (specifically plant) resources which lie within their community.

Herbarium databases being developed at LPB (La Paz), BOLV (Cochabamba), HSB (Sucre) and USZ (Santa Cruz). Short training visits made by Denis Filer to all 4 herbaria in both 2003 and 2004.

Several research databases have also been developed including ‘The Mimosa of Bolivia’ developed by Margoth Atahuachi from Cochabamba.

6.8 Colombia

Projects based at the Herbario MEDEL, Colombia:

- Taxonomic revision of genus Prunus in Colombia.
- Type Catalogue of MEDEL for a later publication in Internet.
- General database of the MEDEL collections. Some 50% of collections are already in the database.
6.9 USA

Various projects are operation in the USA and there is slight increase in activity. These are potentially important as without exception, they are asked to contribute through a BRAHMS Support Agreement.

Louisiana State University is the longest standing project. Contact Dr. Diane M. Ferguson, Collection Manager, LSU Herbarium (LSU), Louisiana State University (dfergu1@lsu.edu).

University of Florida Herbarium, MELASTOMATACEAE of the world, contact Darin S. Penneys on dpenneys@ufl.edu.

Various projects have been initiated in Florida, on the family Melastomataceae. Several grant applications are currently in (2004) including one with with Donovan Bailey in New Mexico to continue work on Leucaena.

The New York Botanical Garden has started to support BRAHMS for projects it works with outside the USA including the Swiss Orchid Foundation at the Jany Renz Herbarium in Geneva and the main herbarium in Puerto Rico.
7 Other and doubtful projects

7.1 Nepal
Earlier DFID support provided under bilateral project at Forestry Research and Survey Centre. Contact was Dr, Rod Bowen. See ‘Establishment of a Forestry Information Database at the Forestry Research and Survey Centre (FRSC), Nepal. Report to DFID by D.L. Filer.’ No recent contact.

7.2 Sri Lanka
Earlier DFID support provided to Forestry Research in Kandy. See ‘Sri Lanka (e.g. see Forestry Research Review databases in Sri Lanka and Nepal. Report to DFID by D.L. Filer Oct/Nov 1992.’ No recent contact.

7.3 Ghana
There has been no feedback from the Ghana Herbarium. A project was started there under the ECOSYN project. One week training course given in 2002.

7.4 Mauritius
Database project initiated 2003. Several recent communications but no firm knowledge of progress. Contact person Claudia Baider.

7.5 Madagascar

7.6 Kuwait
Herbarium curation project. One week BRAHMS training course given by D.L. Filer in 2002. Apparently still active (confirmed October 2004) but little feedback. All collections from Kuwait were ‘transferred’ to Baghdad during the Iraq occupation of Kuwait.

7.7 Bangladesh
National herbarium. No feedback despite attempts to make contact. One week training course was given in 1999.

7.8 SADC region countries
The status of Seed Manager projects in Botswana, Mozambique, Zambia and Zimbabwe remain unknown. There has been a recent communication form Botswana but elsewhere, nothing. There are difficulties with communication/collaboration with these countries at present. However, an eye is being kept on possible opportunities to assist and in part, this will be helped by Kew MSB involvement.
8 Database registrations Jul-Aug-Sept 2004

The following is the BRAHMS Website registrations table. Provided here are data for a 3 month period July to September 2004. Records are presented in original order of registration.

Users need to register to obtain an Activation Key. Keys are changed with each software upgrade. Licensed users are sent new keys automatically. Non-licensed users who have registered frequently are checked to see if they have sources of funding for a BRAHMS Support Agreement. The table has had some columns removed (address lines, email, phone, fax).

Further information can be provided on request.

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