Guide for Version 8

Updated November 2019

Installation and login guide
https://herbaria.plants.ox.ac.uk/bol/brahms/support/installv8

BRAHMS training guide PDF
https://herbaria.plants.ox.ac.uk/bol/content/software/v8/Getting_Started_BRAHMS.pdf
also available using System > Training Guide (PDF) after login

Demonstration database
https://herbaria.plants.ox.ac.uk/bol/brahms/support/conifers

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For licensing enquiries, contact brahms@innovation.ox.ac.uk
For technical enquiries, contact brahms@plants.ox.ac.uk

http://herbaria.plants.ox.ac.uk/bol/brahms/software/v8
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BRAHMS introduced

Managing Natural History

BRAHMS is a management system for preserved and living natural history collections, taxonomic research and biogeographic study. Updated to the latest database technologies, BRAHMS is scalable from the individual research project to enterprise level systems with millions of records.

For collection managers in museums, botanic gardens, herbaria and seed banks and for those undertaking research related to natural history, BRAHMS helps integrate all of your data, increasing outputs and productivity.

The Taxonomic data infrastructure lies at the core of all BRAHMS databases.

BRAHMS has been developed to store all categories of natural history collection.

Development priorities

- Intuitive - similar to MS Office applications
- Scalable - from individual researcher to multi-site enterprise systems
- Taxonomic Core - comprehensive across disciplines
- Integrating Digital Assets - including preserved and living collections
- Modular - allow others to develop, including web-based add-ons
- International - with respect to data store and user interface
- Sustainable and providing custom support
For further information about BRAHMS, visit https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8

BRAHMS v7 users

Although v8 is a completely new system, v7 users will be able to adapt quickly. Most v7 features and functions have been carried over and are more intuitive in the new system. For a summary of some of the key changes between v7 and v8, refer to Annex 2.

A selection of BRAHMS video clips

- Performance in a large database
- Connecting to the conifer demo database
- Create a new database project
- Adding a new user account
- Editing user access and permissions
- Using the species table form
- Adding text entries to taxa
- Using data grid filters
- Selecting visible columns
- Exporting to Excel/CSV
- Merging values - a fast way to tidy your data
- Creating an RDE file for geographic data
- Importing plant names from IPNI
- Importing bird sample data from an Excel table
- Adding species names to an RDE file
- Mapping in action
- Editing map points
- Living collection data: Excel to RDE
- Living collection data: RDE to BRAHMS
- Printing a garden plant list
- Design and print botanic garden labels
- Updating and viewing calculated fields
- Opening, docking and linking tables
- Using tags, filters and maps
- Generating labels and saving to pptx
- Images -> specimen RDE file for data capture
- Tracking edits and using Undo
- Managing transactions
- Deleting records

Licensing and support are managed through Oxford University Innovation. OUI provide rigour to the BRAHMS project and through appropriate licensing, ensure projects receive the service and support they require. With OUI backing, a sustainable and long-term future for BRAHMS is secured.
### Some acronyms and other terms used in BRAHMS

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArcGIS API</td>
<td>Internal mapper used in BRAHMS.</td>
</tr>
<tr>
<td>BGCI</td>
<td>Botanic Garden Conservation International.</td>
</tr>
<tr>
<td>BOL</td>
<td>BRAHMS Online.</td>
</tr>
<tr>
<td>BRAHMS</td>
<td>The acronym originally stood for ‘Botanical Research And Herbarium Management System’. The name BRAHMS is still used – however, the ‘Botanical’ and ‘Herbarium’ are no longer relevant as BRAHMS manages all natural history collections.</td>
</tr>
<tr>
<td>Calculated fields</td>
<td>Fields that are not automatically updated – they are updated using the Recalculate function.</td>
</tr>
<tr>
<td>Collection event</td>
<td>Collection event records store details of collections: who by, when, where, what. They are known as Botanical Records in v7. An event may result in one to many physical specimens. Alternatively, it may be an observation or a recording from literature.</td>
</tr>
<tr>
<td>Custom field</td>
<td>A non-standard data field added to BRAHMS (known as link fields in v7).</td>
</tr>
<tr>
<td>Data Connection</td>
<td>A data connection is a link from the BRAHMS software to a data store. A data store may have one to many databases.</td>
</tr>
<tr>
<td>Database project</td>
<td>A specific database (= project) in a data store.</td>
</tr>
<tr>
<td>Edit History</td>
<td>The history of edits made to the database. This is called Track Changes in v7.</td>
</tr>
<tr>
<td>Gazetteer</td>
<td>A place name added to the main gazetteer table as a collection event location. Often a town name, park name, a forest, a mountain name or similar. If unknown or vague, a description may be stored in locality notes. The place name should be linked to a country and hopefully a major admin area such as a state or department.</td>
</tr>
<tr>
<td>Lookup List</td>
<td>The central lookup dictionary as found on Management &gt; Lookup Lists.</td>
</tr>
<tr>
<td>Merge records</td>
<td>Merging records is used to join one or more records into one. This is used where there are two or more records representing the same thing. Merging records will also process child records, joining these to the selected record.</td>
</tr>
<tr>
<td>Merge values</td>
<td>If there are multiple spellings/formats of a text string in a given field, these can be edited to a standard value using Merge Values on the Summary form.</td>
</tr>
<tr>
<td>Query or Filter</td>
<td>Filter and query and one and the same thing in BRAHMS v8. These actions lead to a selection of your data which can subsequently be processed as you wish (exported, printed, mapped, etc.).</td>
</tr>
<tr>
<td>RDE</td>
<td>Rapid Data Entry. RDE files are external to BRAHMS, used for efficient data capture. Refer to the Rapid Data Entry section.</td>
</tr>
<tr>
<td>Specimen</td>
<td>A physical object of any category, derived from a collection event.</td>
</tr>
<tr>
<td>Tag</td>
<td>A single character mark (default=* in the TAG field. This field is found in all tables.</td>
</tr>
<tr>
<td>Tag groups</td>
<td>Tag groups enable you to set up and save any logical grouping of records, for example a list of species records that are in some grouping, for example ‘Migratory birds’ or ‘Poisonous plants’.</td>
</tr>
<tr>
<td>Transaction</td>
<td>A transaction record describes a loan, exchange, gift or any other category of transaction. You can link specimens and/or living plant material to transactions.</td>
</tr>
</tbody>
</table>
Building a natural history database

Introduction

Some database project examples:

- manage a grasshopper or beetle collection;
- create a catalogue of fungi or cultivated plants;
- produce an annotated checklist for a mountain in Cameroon;
- develop a comprehensive botanic garden or seed bank management system;
- or all of these together within a larger natural history museum or herbarium;
- create an online portal to search and display your data, images and maps.

The development of a well organised database is an important activity for managers and researchers. The strategy you adopt to do this will vary depending on your resources, the amount of data to manage and your short and longer term objectives. However, in all these cases, the paths to successful database development are broadly similar.

Hardware

For individual researchers running their own show, the software and the database will be installed on a personal computer running Windows or on a Mac with Windows emulation. Aside from having sufficient disk space and as much RAM as possible (8GB or ideally more), there are no special requirements other than that the .NET version is sufficiently up to date. However, bear in mind that performance is broadly related to how well resourced your infrastructure is. An under-resourced server and/or client workstations leads to poorer performance.

For institutions with large collections, perhaps many millions, and many simultaneous users, the database will be stored on a server and it is important that this is well resourced. The server will need sufficient disk space, adequate RAM and a good processor. If you try to run any large database on an inadequately resourced server, performance will be poor.

The BRAHMS software itself will either be installed on a shared drive that all users can access – or on individual client workstations. You can also have a set up with remote server log in by users located on different sites. On larger networks, the set up you adopt will be fine-tuned to achieve the maximum performance, a specialised IT task that is not further discussed here.

In addition to the server where the database and usually the BRAHMS software are stored, the role of client workstations should not be underestimated. When you log into the BRAHMS software, the system uses the resources of the local workstation/PC. Thus, even if your server is extremely well resourced, under-resourced workstations will not perform well.

In summary, cutting corners on hardware set up is something of a false economy when it comes to establishing a healthy database environment, all the more so when there are large databases and many users. Institutions need to invest appropriately in managing their digital assets.

Data migration

You may have data in an earlier version of BRAHMS, in Excel or Access tables or in other database packages. These data are important and can be migrated into BRAHMS. V7 databases are automatically upgraded and data in Excel can be imported to BRAHMS via RDE. Data held in other packages may require some form of migration input. However, one way or another, the idea of migration is that you maintain all the data your currently have.

Optimising data capture

Data entry efficiency (speed + accuracy) can be sensibly optimised for all projects, be they small or large. While smaller number of records can be added directly into BRAHMS, the recommended procedure for larger scale
data capture is to use Rapid Data Entry (RDE). Data are added to external RDE spreadsheets (themselves portable mini-databases) and after checking, these data are transferred into the main database. RDE files can themselves be optimised for specific projects by setting up the desired fields and field order.

To take full advantage of RDE, your database can be kick-started by importing useful dictionaries of data, for example collector, taxa and geographic names. Lookup lists can be added for any field where you have a fixed set of values. Although lookup lists can be generated on the fly, it’s usually best to have these defined in advance. You are then in a position to force selection for a defined list or allow the data entry person to add new entries. A more complete range of optimising procedures is discussed in the RDE section.

Exploring your data
One of the key attractions of BRAHMS is that you can explore your data in smart spreadsheets or data grids. While the provided BRAHMS forms are great for data editing, the data grids, together with the many toolbar options, are incredibly powerful for viewing, sorting, filtering, calculating and analysis. Data grids are virtualized, ensuring they are fast even if you are working in table with millions of records.

Reports
Aside from using the data export options provided in BRAHMS, you may want to create report templates for lists, labels, loan forms and others. You can gradually build up a library of handy report templates – and many of the tricks to learn for that are reviewed in detail in the report design section of this guide. Learning to design cool reports is one aspect of mastering BRAHMS where users with interest to do so can go the extra mile, delving into complete range of report design options as laid out, for example in https://www.stimulsoft.com/en/documentation and https://www.youtube.com/user/StimulsoftVideos

Mapping
Most projects want to produce maps and again, all the procedures for creating maps using different GIS options such as QGIS are reviewed in the map section. Bear in mind that if you are online, you have access not only to the in-built ArcGIS API but also the map point location editor. One of the handiest features in BRAHMS v8 is the ability to view data records and map points together, dynamically linking these to highlight the current data record, and respect filters.

Exporting data
Aside from reporting, all data can be exported to Excel or CSV – and all such exports respect your currently selected column views, applied filters and sort order. In v8.1. a new XML designer will allow you to export to XML using a user-defined XML schema.

Special management areas
In addition to the powerful system-wide features and functions listed above, BRAHMS includes specialist modules for managing museums, herbaria, botanic gardens and seed banks. These modules have been developed collaboratively with numerous institutions ensuring that provide the day to day curation and research support that projects need.
Installation

Have an early BRAHMS test version?
If you have been evaluating BRAHMS and have no live databases to keep, we suggest you delete your current BRAHMS software folder, the BRAHMS folders under Documents and any test databases.

Prerequisites and .NET
BRAHMS operates under Windows or on Macs with Parallels, Virtual Box, Boot Camp or equivalent. Your installed Windows .NET framework version needs to be v 4.7.2 or later. If it is not, BRAHMS prompts you to upgrade. If you do have to upgrade .NET, it will be best to restart your PC after. As further discussed below, ideally your workstation will have 8GB of RAM or more. RAM is used by database applications for most operations.

Software folder location
The BRAHMS software folder can be located on a drive that all users have access to, either through a share or via internet access. Alternatively, it can be installed on each local workstation/PC where it will be used. Otherwise, there are no restrictions of the location and/or name of the installation folder.

Disk space and memory requirements
For the complete system installation (including the ArcGIS and reporting runtime libraries, the training guide and other system components) you will need about 250 MB of disk space. This does not include the space required for your data. The demo conifer database requires about 100 MB.

RAM requirements are not strictly imposed. However, as with most database systems, the more RAM you have, the more efficiently the system will operate. Firstly, this needs to be considered for the server itself. For example, the more RAM MSSQL Server has, the better. The server database, independently from the BRAHMS software, will utilize available RAM for indexing, caching and querying. In Oxford, we use a server with 256 GB RAM although BRAHMS itself rarely uses more than 50% of this. If you are using a server database such as MSSQL Server, make sure the database has access to as much RAM as possible.

The RAM requirements also need to be considered for the workstation where you are running BRAHMS from, even if the software is stored on a separate server. Running BRAHMS on a poorly resourced workstation, even if your server is well resourced, will not give the best result. For average use, the workstation you are using should have at least 8GB RAM but ideally 16GB or more.

Whether the software is on the server (above right) or on the workstation (above left), both will benefit from being well-resourced.
Have you got your licence key?

To open BRAHMS, you will need either an evaluation key allowing you to test the system for 60 days or a full licence key. Both are obtained from Oxford University Innovation (OUI).

- Apply for evaluation key: [https://herbaria.plants.ox.ac.uk/bol/brahms/software/evaluations](https://herbaria.plants.ox.ac.uk/bol/brahms/software/evaluations)
- Apply for licence: [https://process.innovation.ox.ac.uk/software/p/14165/brahms/1](https://process.innovation.ox.ac.uk/software/p/14165/brahms/1)

The key you receive will be a long text string similar to:

```
lgBAN8jkR7HNUBBQBmAE5hbuW9U29sYW5ibS8Qcm9qZWN0OiB5b3hCbcB3RhmljEdhcmRiBnMGWRpbnJ1cmdoICgTmF0dXJhbCBIaXN0b3J5IE11c2V1bSNQdXJaGFzZURhdGUgM123MjAxQGEPg4hL3jcIbjaoucSgmBN7OiIM2yDmE637gvJVBArISUK0hY4ph84fKAg= 
```

This key text you will be sent by OUI is copied into the licence form when you first open BRAHMS.

Installing v8

The software is conveniently provided as a single (copy-deploy) zip file.

Open the zip file to any location. Do not use the default windows file extraction tool as this may result in the blocked security status of some files. Please use 7z or similar.

```
bin
Documentation
Logs
Modules
Shared

Files/Folders | Notes
--- | ---
bin | Core application DLL and ArcGIS runtime files.
Branding | [Branding banner image](#) and other branding items as available.
Documentation | Getting Started PDF.
Logs | Daily log files and any application error files.
Modules | Application DLL files linked to specific modules.
Shared | [Shared data connection files](#) and some other shared files.
BRAHMS.exe, BRAHMS.exe.config, BRAHMS.lic, NLog.config | The main application exe file. System configuration files. The [BRAHMS licence file](#) (evaluation systems do not have a licence file).
```

Initially, no installation of additional database management software is required as BRAHMS is delivered with a default SQLite data store. Further information on using MSSQL Server or PostgreSQL is provided below.
Logging into BRAHMS

Brahms.exe and creating desktop shortcut

The top-level BRAHMS software folder contains the file brahms.exe which you run to start the application. You can create a shortcut to this in the normal way. The shortcut on your local desktop may point to the software in any accessible location, be this local or on a drive/server that you have access to.

At this stage, if prompted to update your .NET version, proceed to do this and preferably, re-start your PC.

Login to the personal data store

After installation, you must initially log into BRAHMS using the Personal Data Location. The system will initially default to Windows Authentication using your Windows identity and thus you do not need to add a password.

After installation, logging in using Window Authentication to the Personal database, no password will be needed.

When you first log in, the system auto-creates an empty SQLite data store called brahms.db in your Documents/BRAHMS folder. The folder itself is created automatically. This may be on your physical PC or on a network drive with roaming user profiles. In the latter case, you will be able to access it from different workstations.

If for any reason you cannot log in under Windows Authentication, change this setting to BRAHMS Authentication on the log in form. Choose any username and a password. Passwords are case sensitive. In this case, the username and password will be added to the BRAHMS user file. You must remember a BRAHMS username and password.

First log in and database ownership

The first log in to a newly created database assigns ownership to that database. Thus if you log in using Windows Authentication, your windows account will, initially, be the only way to open the database. Adding or editing different users is discussed in the users and permissions section.
The Database Projects Manager form opens

As initially, the default personal data store is empty (it has no database projects), the first log in will auto-open the Database Projects Manager screen with options New and Import. At this stage, you have three choices:

- Create a New database project.
- Import data from an XML folder you have been provided.
- Close this form and move on to connecting the demo or another database.

This form auto-opens when there are no database projects available in the current data store.

The Documents/BRAHMS folder

When you first log in, a folder called BRAHMS is created in your Documents folder. This is used for the default location of the empty brahms.db data store and some setup files.

If you delete the BRAHMS folder, it will be recreated when you next log in.

<table>
<thead>
<tr>
<th>File/Folder</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>brahms.db</td>
<td>The default SQLite datastore, initially empty.</td>
</tr>
<tr>
<td>datalocations.dat</td>
<td>Encrypted binary file storing connection strings (connections to data stores). All database project details (their names and descriptions) are stored in the data store itself. Once you connect to a data store, the database project(s) within the store are listed allowing you to choose a log in – unless there is only one database project in which case, it logs you directly in.</td>
</tr>
</tbody>
</table>
Localbrahms_v1.config

User specific configuration file holding background image mode, tag highlight colours and a few other settings. Data are stored in JSON format.

Columns

Visible column definitions are stored here as in the species file examples:

```
* Full name and all calculated fields.speciesdataview.dgc
* Full name with protologue.speciesdataview.dgc
* RedList editing.speciesdataview.dgc
```

The .dgc extension refers to Data Grid Column. These files can be exchanged with other v8 users. Also stored are files with .lcv extensions. These store your used last column view per table.

Exports

Any files exported from BRAHMS are stored here. This includes Excel and CSV files.

RDE

RDE files are stored here by default – but you can set up separate RDE storage folders.

```
* Dimoranthera_taxonony.rde
* Field trip 2018_taxonony.rde
* The genus Inga_taxonony.rde
```

Each .rde file is a self-contained SQLite database with the RDE file metadata, the data itself, image links and edit history.

Troubleshooting on logging in

If the copy/deploy BRAHMS install zip is opened using the Windows default extraction, this may block access to some BRAHMS files. When logging in, you may see a message similar to the left-side screen above. The solution is to delete your BRAHMS software folder and then again open the zip file you have downloaded using 7z [https://www.7-zip.org/download.html](https://www.7-zip.org/download.html) or another utility. Another possible explanation is your security system (e.g. anti-virus) requires you to include brahms.exe as a trusted exception.

Licensing and software updates

**Licensing**

Licences to use BRAHMS are provided by Oxford University Innovation (OUI). For further information, please contact brahms@innovation.ox.ac.uk. Evaluation licences are normally for 60 days.

If you have received a licence key from OUI, when you log into the software, simply copy the key into the licence key form when prompted.

**Software and database updates**

Software updates are issued periodically. These may be to resolve reported problems or to issue additions and new features. Users who are within their licence period are eligible to download all categories of software update.

Notification of updates with a software download link are sent to all licensed users with a summary of the update content. The new software folder replaces the existing software folder. As soon as you log into any database, the system will inform you if database structural changes are needed. If databases changes are needed, you can then proceed to auto-update. The database update process uses scripts that are drawn from the BRAHMS website. You need to be online to use the update options.

If you have not updated your software for a longer period, several scripts may be needed and these are automatically run in the correct sequence. The same applies to RDE files. The entire update process is automated.

As soon as you log into a database that requires updating, the system will inform you if database structural changes are needed.
Data stores and databases

The difference between data stores and database projects

The data store refers to the location of your data. It is a physical store in a database management system separate to BRAHMS itself. For example, you may opt to store your data in MSSQL Server, PostgreSQL or SQLite. Each of these is a database management system.

How many databases in a store?

A given data store may include more than one database project. If a single store has multiple database projects (left below), the data are not mixed. If you open a data store with more than one database, the first thing BRAHMS does is ask you to select which database you want to open. You could also create a new store for each separate project (right below). The choice is an institutional matter – the result is very similar.

One database for all?

Storing museum data of different types in separate databases may not always be the best option. Consider that you want to query on all collections or taxa from a selected area or collected during a certain period or by a selected collector – based on all preserved animal and plant records, living collections and fossil records. If these data are combined in the same database, this is possible. But if the data are separated in different databases, it is harder to get the combined results. You would have to somehow combine the data after querying separate databases.

BRAHMS is designed to store and integrate data across collection categories. There is no limit to the number of records and in any case, if you want to query only the Anacardiaceae or Hymenoptera, you can do so.

Note that if data are stored in separate databases, it is possible to connect these to a single web portal via BRAHMS Online, thus combining the queries there.
**SQLite requires no installation**

One of the advantages of SQLite ("Local file system" in the BRAHMS documentation) is that it requires no installation. SQLite datastores can be copied onto your workstation or server either as an empty store or containing one or more databases. After linking your BRAHMS software to the store, you are ready to go.

When you install BRAHMS, it comes with an empty SQLite store file called brahms.db. This is created in your Documents\BRAHMS folder when you log in to BRAHMS after installation. If it is missing in that location, an empty brahms.db file is always created.

The demo conifer database is provided as an SQLite store. SQLite is also used for all RDF files.

**MSSQL Server and PostgreSQL need an extra step**

If you are planning to use one of these stores, you first need to install the required software. This is something that you would normally have done by your IT section. However, MSSQL Server Express is free and can be easily installed by yourself on your local PC. Express is a slightly cut-down version of the fully licensed version of MSSQL Server.

Once the server store software itself is installed, BRAHMS has an option to create the necessary data structures directly from the Data Connections form. However, on an institutional server, you may need administrative access to MSSQL Server or PostgreSQL to do so.

![MSSQL Server database](image)

The above screen shows a typical MSSQL Server database, in this case the store is called ‘Conifers’. The conifer demo database, while normally distributed in SQLite, can also be imported to MSSQL Server for testing.

**Multi-user access**

All data stores and databases within them can be used for multiple user access. Other than the terms of your BRAHMS licence, there is no restriction on the number of users that can simultaneously access a given store/database.

![Multi-user access diagram](image)

Simultaneous edits of the same data by two or more users are discussed in the section on Edit conflicts.
Choice of store

SQLite is intended for small to medium sized projects. It is portable and the entire data store is easily moved from one location to another by copying a single file. BRAHMS always uses SQLite for RDE files which are designed to be entirely portable, operating on a server or from a memory stick.

SQLite is less suitable for large multiple-user projects. Such projects will use MSSQL Server or PostgreSQL with appropriate security and maintenance. Having said that, SQLite can store millions of records – refer to https://sqlite.org/about.html.

<table>
<thead>
<tr>
<th>Data Store</th>
<th>Licensing</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQLite</td>
<td>Free</td>
<td>Provided with BRAHMS. Used for the default personal data store, the demo database and all RDE files. It is possible to download the SQLite database browser but this is not a requirement. See <a href="https://sqlite.org/index.html">https://sqlite.org/index.html</a>.</td>
</tr>
<tr>
<td>MSSQL Server Express</td>
<td>Free</td>
<td>2008 R2 or later see e.g. <a href="https://www.microsoft.com/en-gb/sql-server/sql-server-downloads">https://www.microsoft.com/en-gb/sql-server/sql-server-downloads</a> will function but not strongly recommended for large (tables with &gt; 500,000 records), multiple user databases.</td>
</tr>
<tr>
<td>MSSQL Server</td>
<td>Licence required</td>
<td>2008 R2 or later see e.g. <a href="https://www.microsoft.com/en-gb/sql-server/sql-server-downloads">https://www.microsoft.com/en-gb/sql-server/sql-server-downloads</a> – scalable to any size.</td>
</tr>
<tr>
<td>PostgreSQL</td>
<td>Free</td>
<td>9.3 or later see e.g. <a href="https://www.postgresql.org/">https://www.postgresql.org/</a> - scalable to any size.</td>
</tr>
</tbody>
</table>

Current options for data storage in BRAHMS v8.
Data connections

Introduction

The BRAHMS software is independent from any data store you choose to link to. To allow BRAHMS to access data, you need to add at least one data connection. Data connections have a name so that you can identify them. They also have properties that describe the connection. An example connection name could be ‘BRAHMS on Server 1’. The properties of the connection would include the type of data store, its physical location or address and, when needed, access permission details.

You may have one or more data connections. Connections may be to different types of store in different file or server locations. When you install BRAHMS, a default SQLite connection is added. This is called ‘Personal’ and the location is in your Documents\BRAHMS folder. Each user has their own personal data store.

All connection details are stored in the encrypted file datalocations.dat which is located in your Documents\BRAHMS folder.

Data Connections, Servers and IT help

If you plan to store your data in a locally stored SQLite file, you don’t need any IT support. However, for larger institutions with restrictions on access to servers, inevitably, you will need to have someone to provide access/permission to a server data store. Access to server databases is an institute level matter. As a project, we can advise on storage strategy. But to implement this, you may need support from a server administrator or your IT section.

SQLite connections

When you install BRAHMS, an initial connection is auto-added to an empty SQLite data store. The connection name is “Personal”. The data store has a default location in your Documents\BRAHMS folder and the data store name is brahms.db. Initially, this is an empty file with no database projects. To create a database (or databases) in this store, you will use the database manager.

SQLite connections require no special permissions to use. They do not need the installation of any extra software. In summary, you simply browse to locate the database file. This file can have any name but it will have an extension '.db' as in brahms.db or mydatabase.db.

You can create a new SQLite store and/or browse to locate an existing one.
To create a new SQLite store, Select **System > Manage Data Connections > New.** Provide a name for the connection. The connection provider will be Local filesystem(SQLite). Choose **Create a new file** and choose the folder location and file name as prompted.

To connect to an existing SQLite database, copy the file you have been given (e.g. ‘sampleddatabase.db’) to any accessible folder location. Select **System > Manage Data Connections** then **New** entering a suitable connection name (e.g. ‘My Sample Database’). Select the **Browse for an existing file**... option to locate the file. **Save** this and then close the form. Finally, select **System > Sign out** then log in once more choosing the connection name you added above.

**Creating a MSSQL Server or PostgreSQL data store**

For larger museum or research projects, you will want to create an MSSQL Server or PostgreSQL data store. This can be done from the system’s Data Connections option.

**Example creating an MSSQL Server data store**

This example which uses the express version of MSSQL Server, assumes you are creating a database on your own PC and thus can avoid having to use a DBA login and/or set up additional access rights.

You can easily install MSSQL Server express on your local PC. When doing so, we advise you also install the MSSQL Management Studio. If you have doubts, consult your IT colleagues.

- Log into BRAHMS choosing the default personal store using Windows Authentication. If there are no projects in the store, the Database Projects Manager screen will auto-open. You can close this.
- Select **System > Manage Data Connections...** then choose **New**

Choose a connection name and set the provider to MSSQL

- Select the **Create** option and at this stage, you can **Test** a connection is possible.

The test should lead to a ‘Test Connection Succeeded’ message.

Provide a physical name for the database and then **Create this database**
Successfully created

Following the instructions below

You can leave the User ID and Password blank if you are creating a database on your own PC and there are no administrative restrictions. Test Connection will complete the process.

- You can now sign out of BRAHMS and log in again – choosing the store name you provided e.g. My Museum Datastore. You can choose Windows authentication. If you choose BRAHMS authentication, the system will ask you to enter a user name and password. Don’t forget these.
On the first login, the Project Manager form will open. Choose New and enter a description of the project as prompted. Once completed, you can choose Load Project to open the new project in the newly created data connection.

Creating the appropriate account for accessing the database

These notes are for your Server Administrator. Using the MSSQL Server management studio, a user account should be added under Security > Logins with a BRAHMS database owner role for the newly created BRAHMS database. This user’s credentials will be used to set up access from all BRAHMS v8 software that will be connecting to the BRAHMS database. This can be done manually using the management studio.

Alternatively, you can use a script similar to the below, replacing the word brahms with your own database name:

```
USE [master]
GO
CREATE LOGIN BRAHMS WITH PASSWORD=N'SomePassword', DEFAULT_DATABASE=brahms, CHECK_EXPIRATION=OFF, CHECK_POLICY=ON
GO
USE [brahms]
GO
CREATE USER BRAHMS FOR LOGIN BRAHMS WITH DEFAULT_SCHEMA=[dbo]
GO
```

Where the username is BRAHMS and the password (SomePassword) should be set to something suitable. The first create statement sets up a login and the second adds that login to the database owners role of the BRAHMS database. Once this is completed, you can setup and test a data connection from BRAHMS.

A sample data connection form in BRAHMS v8 for MSSQL Server

Sharing data connections

The connections that a user has and can thus choose from on their login screen, come from the file datalocations.dat. This file is stored in the user’s Documents\BRAHMS folder. However, in an institution with many users, the database administrator may want to share a data connection for all users on the network. This is done using the Share option on the Data Connections form. This creates an encrypted file storing the
connection string. This file is added to the **Shared** folder which is found in the BRAHMS software folder. Any connections added to the Shared folder will be available to all users accessing BRAHMS from the same software folder. Users running BRAHMS from a different installation location can be given a copy of the datalocations.dat file to put in their BRAHMS installation shared folder.

**VPN access and Remote Logins**

If your connection string contains the appropriate entry for the server name, you can set up connections allowing users to log in from outside your institution. The connection is made over the internet. There may be an additional security requirement such as VPN login. The server administrator may also want to register the IP address of the user. Note that the MSSQL Server would have to be enabled for VPN access.

Another tactic is for a user to make a remote desktop connection to a server. Once connected in this way and with appropriate permissions, the user could clearly log in to BRAHMS and access the data store. Remote desktop connection approach is not recommended for large numbers of same time users unless the server is especially well resourced.
The database manager

Introduction
The database manager provides options to add, edit and delete database projects within a given data store. A given data store may have one or several databases. Creating and editing database projects is a lot easier than setting up data connections.

To make a new database project, the first decision to make is where to store your data. If you are testing BRAHMS, you can create a new database project in the default brahms.db personal datastore.

The following section assumes you are already logged in and connected to a data store.

Creating a new database project
Log into the default personal store. If the Database Manager form does not auto-open, select System > Manage Database projects. On this form, Select New and enter the project name and a few details as requested.

Creating a new project
If the store has more than one database, when you next log in to this connection, you’ll be asked to choose which database to load.
Connecting to the demo database

Introduction

The demo Conifer Database is available on: https://herbaria.plants.ox.ac.uk/bol/brahms/support/conifers

The conifer database has been provided by Aljos Farjon, RBG Kew. The conifer database includes all published conifer names with nomenclatural details, IUCN conservation codes, TDWG geographic distribution codes, species descriptions and more. It also includes specimen data across the group, almost all referenced for mapping. The database also includes sample living collections data from Oxford Botanic Garden.


Connecting to this sample database

Quickest approach

- Download the zip file from https://herbaria.plants.ox.ac.uk/bol/brahms/support/conifers
- Open the zip to create the file brahms.db
- Copy the file to your Documents\BRAHMS folder overwriting the default brahms.db file
- Log into Personal using the credentials:

  Authentication: BRAHMS Authentication
  User name: Demo (not case sensitive)
  Password: demo (lower case)

Connect to conifers in a different location

If you prefer to set up an entirely new connection to conifers, perhaps on a shared drive thus allowing multi-user access, follow these steps:

- Copy the downloaded demo database file to any folder location. You can optionally rename the file from brahms.db, for example to conifers.db.
• Select **System > Manage Data Connections**... then **New** and enter a connection name such as *Conifer Database*. The Connection Provider will be the default *Local Filesystem*.

• Use **Browse for an existing file** to navigate to the database file and then select **Save** and then **Done**.

• Sign out. When you next log in, change the Data Location to ‘Conifer database’ or as added above.

**XML import option**

If you would like to import the conifer database to another store type including MSSQL Server, you can do this by importing the conifer database XML. This will be provided on request.
Managing user accounts and permissions

Introduction

Users and database permissions/access information are included and copied within a given data store. Thus, if you copy a personal data store or an MSSQL Server .bak file to another location, the user information will also be included. Passwords are encrypted.

Do not copy a database to another user with only a Windows login as they won’t be able to use that. Include at least one BRAHMS login option. RDE files do not require user login details.

View and edit the database project members list

The database project members list is opened using System > Manage Users and Permissions. This User Management table lists all users with their database memberships. Users registered in the user list who have no database memberships will not be listed in this table. A user with access to three separate database projects will have three entries.

As well as providing the user name, this list indicates whether they are a system administrator, and their project role as manager or user. In Edit mode, the Project Role can be changed. The names and other fields in this grid can be searched and filtered as in any other data grid. Passwords are encrypted and cannot be seen. Note that the System Admin? option cannot be edited from this screen as this is a property of the user rather than database membership.

Editing the user list

Adding and editing users

To edit the user list, select the User List option above the database membership grid. This option is only available to System Administrators.

To add new user account, select the New user... option. The tab Add BRAHMS User asks you to add in the name details and whether they are Admin or not. The other options, Add Windows account and Add Domain User do not require that you add a user name/password as this information is known by the windows/domain...
account. Select Finished after adding the name entry. Login authentication methods are further discussed below.

A note on passwords

Passwords are case sensitive and encrypted. If you forget a password there is no way to visualise it. The only solution is to get the system administrator to use the reset password option when editing a user entry.

Passwords can be reset by the system administrator.

If you are copying a database to another user, optionally delete your Windows/Domain account entries as these will be of no use elsewhere. Certainly, you need to make sure you add at least one BRAHMS user log in (ideally with Administration status) so that the user can log in. This is why the demo conifer database is distributed with the BRAHMS log in user: Demo + pw: demo.

Assigning database access to a user

Having connection access to a data store does not mean that you can open the database(s) within it. To have access to a database project or projects within a store, you must have access permission.

In the above example, a data store includes only one available project. To provide the currently highlighted user (not visible on this screen) access to this database project, use the Add-> option.

Thus, the task of the System Administrator (or in this case also the Database Manager), once users have been added to the user list, is to ensure they are given access to the appropriate database project(s).

Users roles

A user may be designated as an Administrator, Database Manager or a User. Access rights vary in each case.

When adding a new user, you can make that user a System Administrator by selecting that option on the new user form. Administrators have access to all options including adding and editing the user list.

A user can also be made Database Manager. This means that the user has access to the entire database and can assign user access to databases they manage.

To set a user as a DB Manager, select Edit mode and then use the dropdown in the Project Role field.
Login authentication methods

Three types of user login account are available. It makes no difference which is used to the options available in BRAHMS after log in. The login method does not influence the access and permissions settings.

BRAHMS User

The user can log in from any workstation using a BRAHMS user name. Must enter user name and the password. The default Admin level user name and password for the sample conifer database is Demo + demo. These credentials are distributed with the conifer database.

Local Windows Account

This is windows authentication on the user’s local workstation. No user name or password needed when logging in using Windows Authentication as you have already logged in to your PC.

Domain User

Domain users are assigned on institutional networks by the relevant IT person with access to the list of domain users. They can log in to any workstation on the institutional network. With roaming profiles, they will have access to their Documents/BRAHMS folder. No user name or password needed when logging in using a domain account as it uses Windows Authentication.

The Add Domain User options allow the database Administrator to add users from an accessible active directory domain. By entering your domain credentials, the domain users are listed as show above (personal details hidden). These can be selected individually and given access rights to databases.

Access and permissions

Introduction

This section refers to access and permissions within a selected database project. In summary, each user can be assigned access rights to a selected database project. The same user may have different access rights in different database. Permissions are edited by the system administrator or database manager (for databases managed).

A set of permissions can be created and saved as named permissions set. This set of permissions can then be assigned to other users.

Permissions influence the following features:

- The modules or components of modules that a user sees – modules can be completely hidden.
- Where access is provided, this can be set as Create, Read, Update and Delete (CRUD); Read and Modify; or Read Only.
- Additional non-module related access features can be edited such as the ability to merge records or edit map points.

Editing users permissions

Once the user management table is opened using System > Manage Users and Permissions, select the Access/Permissions option.

In this example, a permissions set ‘loans manager’ has been created. The user has full CRUD access to People, Transactions and Addresses – and thus can edit these.
Here, a permissions set ‘visitor’ has been created. The user has read only access to most modules and tables, although this could easily be reduced to selected modules.
An example for a user with full access to the entire system.

**Access permissions to RDE folders**

Access to Rapid Data Entry folders is discussed in the section on [Assigning permissions to RDE folders](#).
BRAHMS setup options and language

Introduction
Setup options are accessed from System > Options… These settings apply to the system as a whole. The options are gradually expanding, those currently available are listed below. Note that user permission options are used to define user level settings.

System background
To set your BRAHMS application background image, select System > Options > Background Image. If you are online, try Bing images of the day. This cycles through some wonderfully distracting images every 30 seconds or so. Bing images are updated each day. You can also display background images from your own image gallery choosing the relevant BRAHMS setup option.

Bing images cycle through a different batch of images each few days. A link is provided on the BRAHMS window below the image to visit the image URL.
Any language

BRAHMS is international with respect to the interface and the storage of data. Translatable resources files are used to manage interface components. This means that the entire system is easily translated to any language.

All system text that appears in the BRAHMS application is drawn from translatable resource files. If you require a different language, you can request this from the BRAHMS project.

Formats for taxa names and authors

You can control how author names appear in calculated species names. For example, you may want to exclude authors or only include the lowest ranked epithet author name.

Note: If author names are excluded by default, you can override this on a name by name basis using the **Force Author options** found on the main Species form:

**No force:** Alnus incana subsp. rugosa var. occidentalis

**Force all:** Alnus incana L. subsp. rugosa R.T.Clausen var. occidentalis (Dippel) C.L.Hitchc.

**Force last:** Alnus incana subsp. rugosa var. occidentalis (Dippel) C.L.Hitchc.
Living Collections

**Status codes**

You can enter the codes that represent plants that are Alive or Dead/Disposed. In fact, the Living Status field in the plants file may have several different codes in addition to these two. The Alive/Dead codes however, are used in some calculations, for example, you can total up the number of living plants per accession.

In this database, A is used to represent ‘Alive/Active’ and I is used for ‘Inactive’.

An example use of the status codes to calculate the number of Alive plants per accession.

**New Accession Code rules**

Refer to the section of accession numbering.
Management

Entering the code of your institution. This is used in the system as your default code.

Mapping

The mapping tab is currently used to enter the location of the exe files for GIS options. By default, BRAHMS will try to locate the GIS installations using your computer’s registry entries but sometimes, this is not possible. The settings here assure that BRAHMS can locate the software.

GIS exe locations.

Modules

The settings here are now redundant as they have been superseded by the Access and Permission settings.

Banner image

The selected banner image appear through the system for example on all form headers. The image is stored in the file banner.jpg in the software Branding folder. After changing this file, log out of the system then re-login.

An example banner in use.
Background image

Use the settings here to choose the application background image. You need to be online to use Bing images of the day.

Background image set to Bing image of the day – the image changes roughly every 30 seconds.

Font settings

The settings here control the font name and size used through the system.

Choose any font and text size. You can restore the default settings.

Grid Views/Highlighting

Here you can adjust tag colours for dynamic record colours and also your data grid line options.
Alter the appearance of your data grids.
Data grid fundamentals

Introduction to data grids and their performance

You do not need to read this section – but it may be of interest to understand more about how your data are displayed and to be aware of some of the factors that influence system performance.

Data grids present data from your database tables on your screen in spreadsheet format. The grids come with a context enabled menu ribbon and toolbar options, rather like MS Office applications. The grids include data from the currently selected table but they also pull in data from related tables as required. For example, with Collection Events, many of the data columns you see are from related tables such as the taxa, geography and people tables. By default, data are not presented in any recognisable sort order. This is because the data are

Some data grids display data from many related tables. These table relationships and the data they present on your screen are managed by various layers of the BRAHMS system starting with the DBMS itself where the tables, their indexes and relationships are managed and then ending up as data on your screen. One of the functions of BRAHMS is to gather these data together, correctly related, and allow you to browse through your data.

A typical data grid, here from collection events. The data in this grid example come from several tables: Tags are stored in a user-specific tag table; collector names come from the people/name-strings table; and the taxa fields some from the family, genus and species tables.

As well as using the resources of the computer storing the database, often a server, these activities are optimised to take advantage of the resources of the workstation you are working on, notably the available RAM. With large databases, the data should be stored on an adequately resourced server. With personal databases, the database and BRAHMS software are likely to be on the same computer.

Clearly, the system cannot bring all the data from large tables into view or into your workstation memory at one time. There may be many millions of records in a single table. Rather, it pulls data from the database store as you move up and down the grid. The process used is called data virtualization. In fact, more data are pulled from the database than you can see at one time and this smooths out the process of browsing.

If you page down through a large table, you will periodically see a small triangle of points displayed in the bottom right corner of the data grid. This indicates that the system is pulling more data from your database and supplying these data to the BRAHMS data grid. If you rapidly page up or down through the data, the data triangle appears more frequently. If the triangle seems to spin for a longer period, it implies the server is busy.

The data access triangle indicating that the system is busy pulling new data from your database into the grid.

If you are working with large tables, for example those with > 500,000 records, you will experience longer delays if you attempt to drag the grid vertical scroll bar up or down. This behaviour is well documented in virtualized data grids. In practice, it is not normally necessary to use the vertical scroll bar. In any case, to locate data effectively, you should use one of the filter/query options.
Using data grid tables

Opening and closing tables in data grids

By default, BRAHMS uses versatile data grids with context sensitive toolbars to browse, locate, select, sort, edit, query and analyze your data. Data tables are opened using a single click on the selected menu entry. The use of forms is discussed in the editing section.

- On the Taxa menu, click once on Families.

When a table opens, the toolbar will usually change to Data Tools as this is where you will likely find what you need to do next. For taxon specific tools or if you want to open another taxon table, return to the Taxa menu - or another menu option as required.

- To close the table, select the X on the top left corner of the data grid. Alternatively use Alt+X

Opening multiple tables

See examples on https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#multiple

You can open and utilise different tables at the same time. The task here is to open the main family, genus, species and collection events tables.

- On the Taxa menu, click once on Families.
- Return to the Taxa menu and click on Genera. Repeat this now for Species. Note that each time you open a table, the Data Tools toolbar is activated – so you have to return to the Taxa menu.
- Finally, on the main menu, select Collections and choose Collection events.

Each table has a tab which can be selected to view the data in that table.

With the opened tables organised in this way, the problem is that you can only view one table at a time. The next task explains how to resolve this.

Docking tables

See examples on https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#multiple

Video: https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#opendocklink

To view the tables opened in the last exercise at the same time, you can use the docking and undocking features. Each table can be detached from its centrally docked position and docked to the side, above or below another table – or dragged off the application to a different monitor. Forms, images, external web sites, maps, query tools and more are all dockable.

Positioning tables and other items takes a little practice as there are many potential docking options. It also depends on how many monitors you have available. The tasks here assume only one monitor – but if you have two or more, take advantage of these to display tables fully undocked.

- Using your mouse, drag table tabs to undock them. This can take a little practice to grab the tab correctly. When you drag any table to undock it, a series of yellow ‘docking boxes’ appear. The challenge is to drop the table on one of the docking options – the central box will redock the table as it was.
• As a first try, drag the genus and species tables and re-dock by placing and releasing your mouse pointer over one of the yellow docking points.

Here the genus table has been undocked and is floating above the other tables. And the species table is about to be docked to the right.

• You can repeat this process with the collection events table, docking elsewhere - or move it to a different monitor.

The various tables rearranged with collections events dragged off the main application

Dock position options vary depending on the windows opened. Some experimentation is required.

Setting grid appearance

System Fonts and grid lines

As discussed in the System settings section, you can configure grid font, text size and grid lines using the options on System > Options.
Navigation and function keys

**Navigation**

There are a few tricks to learn to move efficiently between columns and rows in BRAHMS data grids. Most of the functions used in v8 are similar to those used in Office applications such as Excel.

BRAHMS draws data from the data store into the grids, and presents your data with smooth scrolling and low-lag data virtualization, storing as much data as possible in memory. As you scroll up or down, BRAHMS retrieves the relevant data to memory and refreshes the opened grid.

- **Select Collections > Collection Events** to open the events table. Activate the grid by clicking in any cell. The default is read-only mode, nothing can be edited.

<table>
<thead>
<tr>
<th>Action in non-edit mode</th>
<th>Keys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move to the next / previous column</td>
<td>Right / Left Arrow</td>
</tr>
<tr>
<td>First/Last column</td>
<td>Home / End keys</td>
</tr>
<tr>
<td>First/Last row</td>
<td>Ctrl+Home / Ctrl+End</td>
</tr>
<tr>
<td>Next /Previous row</td>
<td>Down / Up arrow</td>
</tr>
<tr>
<td>Scroll up and down</td>
<td>PgUp / PgDn</td>
</tr>
<tr>
<td>Select or activate a column or cell</td>
<td>Click in the cell</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Action in edit mode</th>
<th>Keys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move to the next / previous column</td>
<td>TAB / Shift+TAB</td>
</tr>
<tr>
<td>Next /Previous row</td>
<td>Down / Up arrow or use Alt+Arrows in memo or numeric fields</td>
</tr>
</tbody>
</table>
**Function keys template – keyboard short cuts**

You can see the Function Key assignments by selecting **Shift+F1** which opens the F Key template. Before selecting **Shift+F1**, click anywhere in a data grid.

<table>
<thead>
<tr>
<th>Modifier</th>
<th>Key</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift</td>
<td>F1</td>
<td>Toggle this list of shortcuts</td>
</tr>
<tr>
<td>Control</td>
<td>N</td>
<td>Add a new record</td>
</tr>
<tr>
<td>Shift</td>
<td>F2</td>
<td>Toggle grid form visibility</td>
</tr>
<tr>
<td>Control</td>
<td>F2</td>
<td>Toggle Sigma summary visibility</td>
</tr>
<tr>
<td></td>
<td>F5</td>
<td>Refresh data grid</td>
</tr>
<tr>
<td>Control</td>
<td>F5</td>
<td>Remove any existing sorts</td>
</tr>
<tr>
<td></td>
<td>F6</td>
<td>Toggle records tag and move to next record</td>
</tr>
<tr>
<td>Shift</td>
<td>F6</td>
<td>Tag all records in the grid</td>
</tr>
<tr>
<td>Control</td>
<td>F6</td>
<td>Untag all records in the grid</td>
</tr>
<tr>
<td>Alt</td>
<td>F6</td>
<td>Filter on tagged</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Toggle records delete flag and move to next record</td>
</tr>
<tr>
<td></td>
<td>F8</td>
<td>Toggle column manager visibility</td>
</tr>
<tr>
<td>Shift</td>
<td>F8</td>
<td>Cycle column autofit widths</td>
</tr>
<tr>
<td></td>
<td>F9</td>
<td>Open a value look-up for a read-only field if available</td>
</tr>
<tr>
<td>Shift</td>
<td>F10</td>
<td>Toggle grid cell content viewer visibility</td>
</tr>
<tr>
<td>Alt</td>
<td>Z</td>
<td>Toggle grid cell content viewer visibility</td>
</tr>
<tr>
<td>Control</td>
<td>F10</td>
<td>Toggle record viewer visibility</td>
</tr>
<tr>
<td>Control</td>
<td>Z</td>
<td>Toggle record viewer visibility</td>
</tr>
<tr>
<td></td>
<td>F11</td>
<td>Toggle advanced query tool visibility</td>
</tr>
<tr>
<td>Shift</td>
<td>F11</td>
<td>Set current cell value as a quick filter</td>
</tr>
<tr>
<td>Shift</td>
<td>F12</td>
<td>Append current cells value to quick filter list</td>
</tr>
<tr>
<td>Control</td>
<td>F11</td>
<td>Deactivate all currently applied filters</td>
</tr>
<tr>
<td>Control</td>
<td>R</td>
<td>Toggle Reporter visibility</td>
</tr>
<tr>
<td>Control</td>
<td>P</td>
<td>Toggle grids print preview visibility</td>
</tr>
<tr>
<td>Control</td>
<td>E</td>
<td>Toggle edit mode for the current grid</td>
</tr>
<tr>
<td></td>
<td>F4</td>
<td>Copy field above (edit mode only)</td>
</tr>
<tr>
<td>Shift</td>
<td>F4</td>
<td>Copy and increment numeric field above (edit mode only)</td>
</tr>
<tr>
<td>Alt</td>
<td>I</td>
<td>Copy and increment numeric field above (edit mode only)</td>
</tr>
<tr>
<td>Control</td>
<td>F4</td>
<td>Copy current record to a new record (edit mode only)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Go to first column</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Go to last column</td>
</tr>
<tr>
<td>Control</td>
<td>Home</td>
<td>Go to first row and column</td>
</tr>
<tr>
<td>Control</td>
<td>End</td>
<td>Go to last row and column</td>
</tr>
<tr>
<td></td>
<td>PgUp</td>
<td>Scroll up</td>
</tr>
<tr>
<td></td>
<td>PgDn</td>
<td>Scroll down</td>
</tr>
<tr>
<td>Alt</td>
<td>M</td>
<td>Toggle magnifier window</td>
</tr>
<tr>
<td>Alt</td>
<td>X</td>
<td>Close the active grid view</td>
</tr>
</tbody>
</table>
Adjust and save column views

Video: https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#columnviewvideo

When you open a table, the default data grid fields will be visible. You can adjust the field views using the Column Management options.

- Select **Collections > Collection events > Grid Tools > Manage Columns...**

The Column Management Tool allows you to select visible columns.

Once you have designed a useful selection of fields, you can optionally save this using **Save layout** on the Grid Tools toolbar. This will create a .dgv file (data grid view) and save this file to your BRAHMS\Columns folder.

You can create as many views as you want – choosing the view using the **Layout** dropdown.

An example view with a selection of re-ordered fields, the records sorted in this case by country + year.

Another handy way to adjust visible columns and their field order is to **right-click** on any of the column headers. This opens a dialogue form with options to show hidden columns and alter the column order.

And here’s another handy way to hide columns:

- Click anywhere on the Family table to make it the active table. Now click in a field you want to hide. Select the Grid Tools tab and then **Hide Current** – this hides the selected field.
In summary, there are various ways to select and view columns in your data grids. Different views are useful for specific editing tasks. NB: Deleting a .dgv file from the Columns folder will remove it from your list.

**Sorting records**

*See examples on* [https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#sorting](https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#sorting)

The ability to sort records, vital for reporting, is also useful to simply locate records and to find errors.

**Sort on single or multiple columns**

Tables can be sorted on single columns by clicking on the header, **Shift + Clicking** on multiple column headers or using the Sorting Tool.

- Select **Taxa > Genera** to open the main genus table.
- Click once on the Family column header to sort A-Z. Click the same column header again to sort Z-A. Click a third time to remove the sort.
- You can combine as many columns as needed using **Shift + Click** on columns headers.

<table>
<thead>
<tr>
<th>Family</th>
<th>Genus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zygynmataceae</td>
<td>Ghosella</td>
</tr>
<tr>
<td>Zygynmataceae</td>
<td>Sangirellum</td>
</tr>
<tr>
<td>Zosteraceae</td>
<td>Phyllopaedia</td>
</tr>
<tr>
<td>Zosteraceae</td>
<td>Heterozosteria</td>
</tr>
<tr>
<td>Zingiberaceae</td>
<td>Paracautleya</td>
</tr>
<tr>
<td>Zingiberaceae</td>
<td>Stadiochilus</td>
</tr>
<tr>
<td>Zingiberaceae</td>
<td>Geocharis</td>
</tr>
</tbody>
</table>

A single column sort, here descending (Z-A).

<table>
<thead>
<tr>
<th>Family</th>
<th>Genus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cactaceae</td>
<td>Winteria</td>
</tr>
<tr>
<td>Cactaceae</td>
<td>Wittia</td>
</tr>
<tr>
<td>Cactaceae</td>
<td>Zehntnerella</td>
</tr>
<tr>
<td>Cactaceae</td>
<td>Zygocactus</td>
</tr>
<tr>
<td>Cafeteriaeae</td>
<td>Acronema</td>
</tr>
<tr>
<td>Cafeteriaeae</td>
<td>Cafeteria</td>
</tr>
</tbody>
</table>

A multiple column sort, here ascending (A-Z).

**Saving complex sort commands**

- Now open the **Sorting** tool. Here you can add fields of any type to create complex sorts. You can save complex sorts using the **Save** option provided.

Using the sort form, any combination of character, numeric, date and logical field can be selected to sort your records. Complex commands can be named and saved for future use.
**Sorting collection events by collector and number**

Collection event field numbers are alphanumeric and thus, by default, sorting the field number column AZ gives an incorrect sort order.

![Collection event field numbers](image)

As can be seen here on the left, sorting these Wilson, EH collections on Field Number gives a bad result. This is resolved using the calculated field # Field Number (sortable) shown on the right which pads the number field with zeros.

- To display this field, select **Grid Tools > # Calc Fields**
- You could now sort the collection events table on the Collectors + Field Number (sortable) fields but in reports, still refer to the column Field Number.

**Date sorting**

You can sort records on the audit fields Created By, Created On, Last Modified By and Last Modified On and such sorts are useful for a variety of purposes. When you add a new record, the data grid is auto-sorted on the Created On field. But you may find it useful to sort on this field (click on field header) at other times, perhaps in combination with other fields.

If you want to sort collection events by date, sort on year, month and day in that field order (shift-clicking on fields for multiple selections).

**Tagging functions**

See examples on [https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#tagging](https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#tagging)

Video: [https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#tagsandmaps](https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#tagsandmaps)

**What are tags?**

Tagging refers to the addition of a single character to the TAG field. This field is available in all tables in the first position. Tagging has multiple uses throughout BRAHMS with record selection and grouping. While the default tag symbol is *, you can tag records with different symbols or numbers. Each of these can be assigned a colour.

Tags are user-specific, thus one users tags do not interfere with those of another working in the same table. This is achieved by holding tags in a related table that includes the table name, the record GUID, the tag character and the user ID.

Select **System > Options >Grid Views/Highlighting** to edit the default colour options.
Clicking on the Tag toolbar option (or the F6 key) adds the selected symbol to the TAG field. The tag toolbar dropdown provides further options.

Tag all, counting, filtering, clearing and inverting tags

The Tag toolbar dropdown provides a list of handy tagging options.

<table>
<thead>
<tr>
<th>Transfer tags</th>
<th>Copy tags to child or parent records, e.g., species tags can be copied to all collection events, specimens and det history records. Or you could tag all species of tagged collection events.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count tags</td>
<td>A simple count of all tagged records.</td>
</tr>
<tr>
<td>Filter on tagged</td>
<td>Show only tagged records</td>
</tr>
<tr>
<td>Tag all</td>
<td>Tag all records in table – respecting any filters</td>
</tr>
<tr>
<td>Clear all grid tags</td>
<td>Remove your tags from all tables – does not respect filters</td>
</tr>
<tr>
<td>Clear current grid tags</td>
<td>Remove your tags from the current table – respecting current filters</td>
</tr>
<tr>
<td>Invert tags</td>
<td>Tagged records are set to no tag; records that had no tag are tagged *</td>
</tr>
<tr>
<td>Tag with</td>
<td>Choose tag symbol from list</td>
</tr>
</tbody>
</table>

Tag groups

You can manage and save your tagged records using the Tag Group Manager. This allows you to save tags for any table to named tag groups. You can create as many tag groups as you need per table. See examples on https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#taggroups.
To create a tag group in any table:

- Tag the records using one or more tag symbols.
- Select Tag > Tag Groups on the Data Tools toolbar.
- Select New Group and add a Group name at the top of the form. Then Save the new group.
- Ensure the new group entry is selected in the left side pane of the form and then select Save Tags. This will add the tag details to the newly created group.
- Close the Tag Group form.
- You can restore these tags at any stage later on using the Load Tags option.

Creating a new tag group

An example of Tag Groups. In this example, records with Red list code EN VU and CR have been tagged with the symbols 1, 2 and 3 respectfully and these tagged records have been saved to a group called 'Red List EN VU and CR taxa'
Tag Transfers

The ability to transfer tags between related tables opens up numerous options for record selection and processing. In summary:

- You can copy tags DOWN from a table to all the child records in related tables, optionally extending this to all descendant child records in all related tables.
- You can copy tags UP from a table to all the parent records in related tables, optionally extending this to all ascendant parent records in all related tables.

Select Tag > Transfer tags on the Data Tools toolbar.

Example 1. Tag some species records and then transfer the tags DOWN to all collection events and garden accessions of those tagged species. Or extend this to all specimens, determinations, garden plants, seed records, etc.

Example 2. Tag some species records and then transfer the tags UP to all genera of those tagged species. Or extend this to all genera, families and higher classification records for the tagged species.

Example 3. You may have created a tag group in your species table for ‘Medicinal plants’ or ‘Native species’. Having restored the relevant tags to your species table, it would then be possible to tag all living plants in a garden database that are medicinal or native. Equally, you could tag all collection events and the specimens.

Example 4. Creating a checklist for species in a map area. In collection events, you could use the map search to select collection event records. After tagging all the records in the grid (auto-filtered to the map search area), these tags could be transferred up to the species table. In the species table, you could now select the tagged records and use these to build a checklist.

Tag matching records

Using the Match/Transfer option, you can tag records in the open table that match criteria in a selected Excel XLSX table. This option is described in the Match/Transfer data section.

Record Zoom and Cell options

The Zoom option displays the contents of the current record as a vertical list of fields and data values in a side window. This is a handy way to see all the data added to the current record. You can select to include or exclude fields with no values.

It also provides a useful way to navigate to data grid columns - double-clicking on a field name locates the column. If the column is not currently visible, it will be set to visible.
The Record Zoom window. Double clicking on any field name in the Zoom window (here Family) locates the selected column in the data grid.

Here, the Zoom window is opened but filtered to show fields including the text 'col'. Also, the Cell Zoom window is opened and conveniently docked below the Record Zoom.

Column summaries

See examples on [https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8colsum](https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8colsum)

Totals entries for the selected column

The column summary option lists the different values in the selected column and providing the total number of records per value.

- Select Collections > Collection events.
- Locate and click in the column # Full Name and then select the Summary option on the Data Tools toolbar.
Here, the summary shows the number of collection events per species. Moving to a different column will update the summary – assuming Auto-update on column change is selected. Click on the summary columns to sort by field name or count.

You can now open any table and test this function in any column. As you click through different columns, the summaries auto-update unless the form option Auto-update on column change is disabled.

**Application of filters**

The Column Summary tool also allows you to select values to filter on. You can select one to many of the values in the summary list then Apply Filters.

The summary option can also be used to apply filters on one or more selected values.

**Value merging**

The summary tool also allows you to merge ‘same data’ values, typically where there are multiple entries (e.g. spelling errors) of the same value. Value merging is discussed in a separate section.
Calculated fields

Many BRAHMS database files include calculated fields (# fields). These store summaries of information about records in these tables, usually numeric totals or formatted text strings. Calculated fields are not auto-updated. Rather you must periodically use the Recalculate option on the Data Tools toolbar. This updates all of the # fields in the opened table.

Examples of numeric and string calculated fields are:

- # collection events per country in the country table
- # images per species in the species table
- # specimens per collection event in the collection event table
- Species full name in many tables
- Text date formats in RDE for specimens
- Gazetteer summaries in RDE for specimens

Calculated fields are read-only and are displayed using a different column header colour. The field name headers start with # as in '# Collections' and '# Full Name'.

You can display # fields individually using the standard column selection options on Grid Tools > Manage Columns. Alternatively, enable all # fields at once using the toggle option Grid Tools > # Calc Fields.

Some example calc fields in the main species table.

Calculated date fields in an RDE file.

Tables can be sorted and filtered using calculated fields and these fields can be included in reports. They are often useful when producing reports.

Together with the long and short date fields, the RDE fields #Gazetteer Summary and #DGMS are useful when creating label reports.

An example of calculated fields in the main country table

- On the main menu, select Geo > Countries. Then on the Data Tools toolbar, select Recalculate and update the calculated fields as prompted.
On the Grid Tools toolbar, select **Manage columns** to open the Column Management window. Here you can select the fields you want, to include some calculated fields.

Some of the #calc fields in the main country table.

**Tree views**

See examples on [https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#treeviews](https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#treeviews)

Tree Views provide an excellent way to locate, explore and filter data as well as tracking down spelling errors. The Tree View designer allows you to create and save your own views with up to 10 hierarchical levels, and as many views as you need per table. Once opened, you can then use the locate and filter options offered, for example 'filter on selection' when you click on any tree level.

This example shows a single level view to explore by genus. With 'filter on selection' selected, clicking on a Tree View entry filters to that value and updates any linked data, in this case, the map. The windows have been docked and re-sized.

- In the demo Conifer database, select **Collections > Collection events** - select the **Tree View** option on the Data Tools toolbar. Default trees are provided for some tables.
- On the form, select **Tree View Designer** and choose Genus. You can construct views with any fields you need, and in any order.
- Optionally name and save this view – or simply load the view using the option provided.
Select the option **Filter on selection** at the bottom of the form. Clicking on and genus will now set a filter to that name. Click on a genus to set the filter.

Now, on the main menu, select **Maps** and choose **ArcGIS in BRAHMS**. This will draw a map of your selected genus based on the available collections. Do not restrict to **Tagged only**.

Clicking on a different Tree entry will now update your data grid and map.

By default, the Tree View and the Map are docked together. You can drag the lower screen Tree View tab to separate it and arrange your windows as shown in the example above.

**Saving data to Excel or CSV**

See examples on [https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#exporting](https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#exporting)

Data are easily exported to Excel spreadsheets using the **Tag -> Excel** or CSV options on the **Data Tools** toolbar. Exporting works only with tagged records and will export the currently selected columns.

In this task, export specimen data from BRAHMS, sorted by family and species name, restricting the export to some columns and the filter selection to holotypes.

- Select **Collections** from the main menu and choose ‘Preserved Specimen’ using the Category drop down.
- Select **Specimens** to open that table.
- Now select **Grid Tools > Manage Columns** and here you can remove any columns you don’t want to export and sort the table as wanted.
- Locate the Type Category column and enter ‘Holo’ or ‘holo’ in the filter bar to apply a filter on Holotypes.
- Select **Tag > Tag all**
- You can now use the **Export** option to save the tagged records.

Using the grid filter option to restrict to specimens that are holotypes. This example from the Conifer database also restricts to China.

You can list all saved files using the **View** option on the Export Data toolbar section.

**Copy and paste records**

In data grids, you can click on a record to select the record. You can use Shift+Click to select groups of contiguous records or Ctrl+Click to select individual records – the same as in other packages. Selected records are displayed in a shaded colour. Copy the selection using Ctrl+C. You can then paste Ctrl+V these records elsewhere, for example to Excel. Be sure to select the correct paste option to format the data appropriately.
Find, Filter and Query

Video: https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#datagridfilters

Introduction
Filter and query are one and the same thing in BRAHMS. They restrict the data in the opened table using one or a combination of selection criteria. You can then view, report, map, analyse or export these data. There are several ways to filter/query your data – as discussed below.

Queries using the data grid filter bar
See examples on https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#explore

Use Shift +F1 to open help with grid filter options.

- Open the main file collection events table using Collections > Collection Events.
- Enter values into the top filter row as shown below. You can use operators =, <, >, <=, >= and combine values using capitalized AND/OR statements.
- You can also use keywords NOT =Null to show non-empty strings or =NULL to show empty strings.

Using the grid filter row, you can add values to as many columns as needed.

Setting a barcode range using the grid filter row.
- You can use * to select ‘starts with’ and ‘ends with’, thus:

Setting a filter where collector name starts with ‘ter (left) or includes ‘ter’ (centre) and right, where the genus ends ‘illa’.
Press `SHIFT+F1` to open help option for F keys and grid filter syntax examples.

**Queries using Selection and +Selection**

You can set filters on current cell values using the **Selection** and **+Selection** options.

- Open the main file collection events table using **Collections > Collection Events**. Set a filter on a cell value by clicking on the value and then the **Selection** toolbar. This option overrides any previous filters.
- You can add multiple cell based queries using the **+Selection** option. As soon as you select **Selection** rather than **+Selection**, the filter will be again restricted to a single value.

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**Grid filter-bar syntax examples**

- **cyn**: Entering cyn in the FAMILY column would include the family Apocynaceae, amongst others.
- **><pinaceae**: Entering < > pinaceae in the FAMILY column would exclude the family Pinaceae.
- **NOT pinaceae**: Entering NOT pinaceae in the FAMILY column would (as using < >) exclude the family Pinaceae.
- ***rus**: Entering *rus in the GENUS column would include all genera ending rus.
- **rus**: Entering rus* in the SPECIES column would include all species starting rus.
- **=excelsa**: Entering =excelsa in the SPECIES column would include all species named excelsa.
- **>2000**: Entering >2000 would include all entries > 2000 in the selected field.
- **<2000**: Entering <2000 would include all entries > 2000 in the selected field.
- **>=1800**: Include only records that are greater than or = to 1800 in the selected field.
- **<=100**: Include only records that are less than or = to 100 in the selected field.

**Using Conditional Operators**

The items in a column can be filtered according to more than one value by separating those values with the AND or OR conditional operators.

These operators must be in uppercase.

- **AND**: Include only records that are selected by all the filtering criteria. Thus entering vir AND sub in the species FULLNAME column would include entries such as Juniperus virginiana subsp. scopolorum.
- **OR**: Include only records that are selected by at least one of the filtering criteria. Thus entering pin OR pod in the FAMILY column would include entries such as Pinaceae and Podocarpaceae.

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**Using the Selection toolbar options.**
Building and saving more complex queries

Using the main Query tool form, you can design and save your own queries. Queries, which generate visible SQL commands, can mix and match fields of any type. Each command you add is saved unless you remove it from the list. You can then selectively enable and combine the one-line commands and optionally name and save combinations of commands.

- Select the toolbar option to open the main Query Tool. Use the various drop downs to add the query command(s) you want, using Add to add the command to the command list. The AND/OR settings should be adjusted if necessary.
- Use Apply filters to run the query.

![An example Query Tool form with previously used commands, three commands enabled. You can name and save a combination of query commands. The Query Tool form can be undocked and dragged off the application.](image1)

![A further example Query Tool form with previously used commands, three commands enabled.](image2)
Barcode searches

Barcodes can be used to locate records quickly and uniquely. In the main collection event or specimen tables, enable the barcode search toolbar using the Barcode Search option on the Collections menu.

In this example, 6 records have been located using the barcode search option. Barcodes would be normally be scanned into the search field using a barcode reader. However, you can also manually type or paste in barcode values.

As barcodes are scanned, assuming located, they are tagged with ‘B’. The number of B tagged records is indicated. As tags are user-specific, you can scan/tag barcodes without interfering with another users tags.

To view the selected record(s), use the filter option provided on the barcode toolbar.

In this example, 5 records have been located. Note that the filter option adds ‘=B’ to the tag grid filter box. If you continue to search for new barcodes with the filter on, the newly located records are added to the filtered list.

Executing an SQL command

In the current version of BRAHMS, the SQL features are under development. These will be extended to create a saved table of SQL commands with restrictions and command guidelines that include field selection. SQL commands will only be available to selected users.

The ability to use SQL commands and functions directly in BRAHMS opens up a further dimension of editing flexibility. It is never essential to manually issue SQL commands as discussed here. However, if you do, it can make certain types of task much easier, for example, when editing all of the records in an RDE file. Using SQL commands can speed up some editing tasks enormously.

For example, imagine in an RDE file with several 100 records, you want to replace all occurrences of the text ‘SN’, ‘sn.’ and ‘No number’ in the NUMBER field to a uniform ‘s.n.’ value. With the correct SQL command, the task can be done in seconds.

Meanwhile to test the concept and see what’s coming:

- Select Taxa > Species to open the main species table.
- On the Data Tools toolbar, open the main Query Tool and select the SQL tab.
- Edit the command area to: UPDATE species SET Taxstatus = '!!!' WHERE taxstatus = 'accepted'
Select the **Execute SQL** option on the form.

After doing this, select **Refresh Data** on the **Data Tools** toolbar – this will update your view of the data.

To reverse this edit,

- Edit the command area to: `UPDATE species SET Taxstatus = 'accepted' WHERE taxstatus = '!!!'`
- Again, select the **Execute SQL** option on the form and Refresh the data.

The completed SQL command tool will be available in the next BRAHMS release. We may initially restrict its use to RDE tables.

**Find anything – anywhere**

When you open any data grid, you can use the **Find** option to locate any text or a number in any grid cell. Cells that include your text are highlighted in yellow.

- To test, in the open database, select **Collections > Collection events**. Click anywhere on the data grid to activate the **Find option** and then select this to open the **Search** box. **Ctrl+F** also opens this option.

Using the search box navigation arrows, you can move to the next or previous matching cell. Alternatively, use **F3** or **Shift+F3** to move forwards and backwards respectively. Press **Esc** to clear the search and **Esc again** to close the option.
Adding and editing data

RDE vs Database
You can add new data records directly to your database or, alternatively, add new records to Rapid Data Entry (RDE) files and then transfer these data to your database. If you are adding just a few records, it’s usually easier to add directly to the database. For bulk additions, use RDE.

Edit mode
Data can be added and edited in RDE and in your main database tables. By default, tables are opened in read-only mode. To enable Edit mode, select the Edit option on the Data Tools toolbar or enter Ctrl+E.

The behaviour of the data grids changes slightly in Edit mode. For example, you will find that TAB and Shift+TAB are needed to move through the fields rather than the left and right arrows.

Data are autosaved whenever you exist a field or change a row. If you do not see the change in your grid, use the Refresh Data option on the Data Tools toolbar.

Details on how to use lookup functions are provided in a subsequent section.

Adding records
New records are added using the Add option on the Data Tools toolbar. You can add a single blank record – or add new records in batches as offered on the Add drop-down. Each new record is assigned a GUID primary key (not visible unless selected). Adding batch records is especially handy in RDE – and can be faster.

New records can be added one by one or on batches.

Editing larger text fields
Larger text fields (known as memo fields in v7) can be edited in the data grid itself or, by clicking on the field edit icon, in a separate text editor window.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>With Allea forestii var. georgica, Latis patula; Serf, Sali, Lisi are on steep W-facing mountain slope in gravelly fern.</td>
<td>On riverbank in woodland, with e.g. Acacia melanoxylon, Lepidospernum montanum, Hakea microcarpa, on alluvial sand with soil.</td>
</tr>
</tbody>
</table>

Longer text fields can be edited in the data grid or in a separate text editor window.
Large blocks of text can be added and edited using the Text Editor. You can paste or drag and drop text to the Editor with no limit on text length or character set. Aside from the click-icon, you can use Ctrl+M or Ctrl+T to open the text editor.

You can also increase row height to edit large text fields in the data grid without opening a separate text editor.

What cannot be edited?

Some fields in data grid and forms cannot be edited. Mostly, these will be fields that are visible but belong to another table. In some cases, these fields will have specific lookup functions, an example is the species #Full Name field in collection and accession files. But in other cases, data from related tables must be edited in the relevant file. Examples are the species table fields Habit and Growth form which can be viewed but never edited in the living collection accession file.

Audit fields

When new records are added the audit fields Created By and Created On are filled. When a record is edited in any field the fields Last Modified By and Last Modified On are updated. These fields cannot be edited but can be used to apply filters and sorts.

The Audit fields are auto-updated as you add and edit data.
An example filter on the Created On field. When filtering on dates, use a valid date format. You can use functions as here > 01/01/2009 AND <= 10/01/2009.

Viewing add/edit dates and name of person adding/editing in the main species file. You can sort on any of these columns and also use the Summary tool as shown here for the created-on date field.

**Data forms**

Video: [https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#speciesformvideo](https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#speciesformvideo)

Forms are provided for most of the main grids. As well as being used for data editing, they also provide options to list related records and calculated fields. The data on forms update as you navigate to different grid records. Forms can be docked (default) as you like and re-sized. All form text is translatable.

In order to edit data on forms, you need to be in Edit mode. If you are not, data will not be saved and lookup options are not enabled.

Most forms have the option to edit data and then **Save** or **Cancel** the edits made. Once any edits have been made, the form is given a red surround.

As an example, select **Taxa > Species** and then select the **Form** option on the **Data Tools** toolbar. This opens the species table form, by default docked right.
Data can be viewed and edited using grids or forms. Forms can be resized, docked or dragged to separate monitors.

Summary of collections on the main species form.

Find and Replace

The Find and Replace tool on the Edit dropdown works in text columns that are not read-only.
The Find and Replace tool.

An example in an RDE file adding in a country name to all records.

Find and Replace options:

- The 'With' term will be substituted for the 'Replace' term exactly as entered.
- Optionally restrict edits to tagged records.
- To replace null or empty values leave 'Replace' blank. To replace with a null value, leave 'With' blank.
- The 'Replace' term can contain '%' wild cards:
  o '%term%' is equivalent to 'contains term';
  o 'term%' is equivalent to 'starts with term';
  o '%term' is equivalent to 'ends with term'.
- To match only whole words, include spaces - for example '% term %' would locate 'term' only when prefixed and suffixed by a space.
- To use a '%' character in the 'Replace' term you can double it. Thus to find the text '100%' you should use '100%%' as the 'Replace term (or '100%100%%' for 'contains 100%'

Deleting records

Marking records for deletion

Records are first marked for deletion using the Delete option on the Data Tools toolbar or the default F7 key. This adds * to the DEL field and displays the record in a strikeout font. Repeating the action for a record marked for deletion will un-delete it. You can manually add * to the DEL field or, with appropriate permissions, use an SQL function. For example: UPDATE species SET DEL = '*' WHERE taxstatus = 'uncertain'. This would mark the records for deletion. You could reverse this using the command UPDATE species SET DEL = '' WHERE taxstatus = 'uncertain'. Or simply use the toolbar option Delete > Clear Del tags. Records only marked for deletion are fully recoverable.

Removing records marked for deletion

To remove records marked for deletion, a second step is required. Deletion cascades to delete linked child records. Thus, if you delete a species that has linked collections, specimens, text and common names, these too would be deleted. The system advises you of the consequences of a deletion.
The species table with several records marked for deletion. To finally remove these records, select **Delete > Remove records marked for deletion**. This leads to a message box that lists the consequences of deletion. As a rule, deletion of a record leads to the deletion of all its child records.

In the above examples, the deletion of the species or the families would also delete the records listed in the message boxes. The deletion of three accepted family names in the demo conifer database would lead to the deletion of all the records as reported.

To test deletion in the conifer demo database, select **Geo > Gazetteer**. Optionally, you may could set a field view to include the # Collections and # Species together with the locality name.

- Locate the gazetteer ‘Bat Dai Son’ in Vietnam - mark for deletion. Then select **Delete > Remove records marked for deletion**.

Deleting this gazetteer record would result in the deletion of several collection events and their specimens and dets.
Merging data

Merging values

To merge different data values that represent the same thing, use the merge option provided on the Column Summary tool. This option does not merge records, rather it simply ensures that the different values you select are edited to the selected value. You could do this manually, record by record – but the column summary tool provides a convenient way to see and tidy such errors.

This option does not work on read-only fields. This includes those fields that are visible in a table but are in fact, related from another table. Thus, if you see multiple spellings of a collecting place name in the collection event table, make the necessary edits in the gazetteer table.

In the above gazetteer table example, there are two spellings of Alpes Maritimes as Major Admin names. The two values have been tagged - and to double check the records, a filter has been applied to the data grid records using the option provided on the Column Summary form.

The Merge to Selected option, in this case will make both spellings the same (Alpes Maritimes). Records themselves are not merged. The option can be used to merge many values at the same time. The currently selected record is deemed to be correct value.

Merge values or merge records

Merging values is useful in data fields where the data you are merging have no child records. Examples are multiple spellings of Habit or Red List codes in the species file and multiple spellings of a major area name in the main gazetteer table. However, whenever a record had the potential to have child records, the records themselves should be merged. As examples, this would apply to multiple entries for higher classification, family, genus, species, collector, country, gazetteer, garden areas, and institute names. The sample principle applies to merging collection events, plant accessions, plant plants and seed records. In each case, any child records, after a merge, would belong to a new parent record.

Merging records

Merging records is where 2 or more records are joined into one together with any children records. A typical example would be where there are two identical genera in the genus file, perhaps linked to different families. Merging these records means that all taxa connected to the incorrect genus or genera will be moved to the one you select. Another example would be merging place names (joining all collection events); merging species (potentially joining many types of records).
The genus Acacia, added 3 times under three families are merged to a single entry under the selected family.

Match/Transfer data – Excel to BRAHMS

Matching data introduced

The Match/Transfer option on the Data Tools toolbar can be used to match data between the currently opened table and a selected Excel XLSX file. You can use this option to tag records in BRAHMS that match those in the XLSX file. You can also transfer selected columns from the XLSX file into BRAHMS based on your match criteria.

The Match/Transfer option has multiple applications to match and import data.

If you have an Excel .xlsx file and you want to know which records in this file also occur in the opened BRAHMS table, you can use the matching tool. Matching allows you to choose the fields to match on. In some cases, there may be an obvious field to match on – for example a barcode (given that barcodes should be unique in your database). There may be other cases where you have a unique matching code, for example PlantID or a species code inherited from another database and stored in BRAHMS. Also see the section on GUID matching below. However in other cases, your Excel file may have a series of fields to use to match on, for example Family + Genus + Species + Subspecies + Variety + Cultivar. Another example may be Collector name + field number + collection day/month/year + Country. The challenge is to choose the most appropriate match criteria.

Bear in mind that you may or may not be looking for a 1:1 match – this depends on your objectives and in particular, if you are planning to match and then transfer data.

A worked example of matching – specimen table

The following example illustrates how you can match data from an Excel .xlsx worksheet and the opened BRAHMS table. You can substitute this example with data from any .xlsx file you may have – in any BRAHMS table.

- In the conifer database, select Collections and under the Category Preserved specimens, select Specimens.
- As there may already be tagged records in your data file, it may be worth using Tag > Count tagged to quickly check.
- Tag some records with barcodes and then save these tagged records to Excel. Note that the data saved to Excel will be those columns that you had in your current view. In this example, you may simply choose to export the barcode field to Excel.
• Select Tag > Clear current Grid Tags.
• Select Match/Transfer on the Data Tools toolbar and locate your Excel XLSX file as prompted. In this example, you can match the records using the barcode as shown below.

Here, the example is only matching on the barcode. Note that the actual field name is SpecimenBarcode. You can use the Remove All option to unlink all the possible match fields and then manually choose. Note however that you could choose to match on all fields which in this case (as the data were exported directly from BRAHMS), would give the same result.

After selecting Match Excel to your data, the match success is reported. The number of matches is also reported.

The matched records in your database table will now be tagged.

To illustrate the importance of appropriate matching, the same Excel file used above is here matched on collection year. Because the specimen table in BRAHMS has many collections from e.g. 1974, all have been matched. It may be that you want to tag all records from these years—in which case, this would be the correct choice. But not if you plan to transfer data (see below).
A worked example of matching – species table

If you do not have an obvious, single match field such as barcode, you can choose those fields that you consider will give the best match. In the below sample, records in the main species table are matched using multiple fields Genus, Species, Species Author, Subspecies and SubSpecies Author, Variety, and Variety Author.

- In the conifer database, select Taxa > Species.
- As there may already be tagged records in your data file, it may be worth using Tag > Count tagged to quickly check.
- Tag a select of records and then save these tagged records to Excel. Note that the data saved to Excel will be those columns that you have in your current view.
- Select Tag > Clear current Grid Tags.
- Now select the Match/Transfer option on the Data Tools toolbar and locate your Excel XLSX file as prompted. In this example, you can match the records using the taxa fields as shown below.
- To further illustrate the matching process, open your saved Excel file and edit the data to make one of more records obviously not match.

One record has been edit to force a non-match between this Excel file and the database.

In this example, of the available fields in the Excel data file, only some are selected. In fact, as these data were exported from BRAHMS for this exercise, all the fields could be selected – or only #Full Name and the result would be the same. The matched records will now be tagged in your database.

GUID matching

If you are exporting data from your own BRAHMS database with a view to editing these data and transferring these edits back to BRAHMS, one useful trick is to include the Record GUID when saving to Excel. This field is unique and thus guarantees a 100% unique record match.
Including the Record GUID means you can easily match records on this single field. This can only be used if the data are being matched with the same database.

**Transferring data**

In matching records, you may only be interested to know which records match and to tag these matches. However, you may also want to import data from the external Excel file into the current BRAHMS table. This is achieved by ticking the Transfer option for those fields you wish to transfer. Note:

- Any field selected for transfer is not used for matching.
- The Overwrite option, if selected, will force overwrite existing values. If not selected, only null fields are updated.

In the above example, the excel file is matched on a selection of taxa fields. Three fields have been selected for transfer, forcing an overwrite. Also note that the Excel file includes some differently named fields (e.g. “Habit (from John”)”. These have been appropriate mapped to the correct field in BRAHMS.
The data provided in the Excel file have now been added to BRAHMS.

**Excel to BRAHMS field matching**

When importing data from Excel, for example into an RDE file or when using the Match/Import tool, BRAHMS has to know how to map or match your Excel columns to the correct fields in BRAHMS. For example, you may have a field in Excel with the column heading ‘Decimal Latitude’ that you want to go to the standard BRAHMS field ‘Latitude’. Or you may have a field in a different language such as the Portuguese ‘País’ or the Chinese ‘国家’ that you want to map to the BRAHMS column ‘Country’.

You could edit your Excel fields to have standard BRAHMS field headings. But this is not very useful as:

- you would need to do this for each Excel file and
- you would have to know the correct BRAHMS field names in each case.

The good news is that field matching is managed by the Excel to BRAHMS template file *ExcelColumnMatchTemplate.csv* which can be found in your BRAHMS folder. This is a basic file with two columns, one for the Excel column heading, the other for the BRAHMS column heading.
An example matching template ExcelColumnMatchTemplate.csv showing a selection of match fields.

You can edit this file directly, adding or removing entries. However, BRAHMS automatically updates the template when you use matching. Allowing BRAHMS to update the template guarantees that the BRAHMS field names are correctly assigned. Note:

- Multiple variations for the same field may be given, all pointing to the correct BRAHMS field.
- If you open this file directly in Excel, you may find that some Excel fields with accents are displayed incorrectly. However, if you open the file using Notepad, they will be displayed correctly.

Managing edit conflicts

An edit conflict occurs when one user displays data in order to edit it, and then another user updates the same data before the first user’s changes are written to the database. In this case, there is a danger that whoever updates the database last overwrites the other user’s changes. Although in practice these conflicts are quite rare, in systems with many same-time users working on the same type of data, they can occur.

While it is not possible to prevent users trying to edit the same record, BRAHMS will prevent these conflicts by not saving data that has changed since it was retrieved. Typical example:

- User A opens the species table including a record on *Passer domesticus*. User B also accesses the same record. Thus, both users have the same record in their respective data grids at the same time.
- User A saves a change to the record. The edit is now in the main database but is not displayed in user B’s data grid (unless by chance, user B decided to use the Refresh option).
- User B edits the same record on *Passer domesticus* and saves it. However, the last modified date/time in the database is now later than that which user B started with which enables the system to issue a warning and prevent user B overwriting the edit made by user A.
Data verification

Introduction

Data verification allows users with access to this function to mark records with a verification status. This function can be used for all records in any table. Records can have multiple verification status entries. It is possible to review the status of records, optionally restricted by status code and/or the user who provided the status.

Providing permission to edit status codes

Users must be given permission to edit status codes by the database administrator(s). This setting is found on the main Permissions form opened by selecting System > Manage Users and Permissions and ensure the settings are applied appropriately for the selected user.

Editing verification status codes

Verification record status options will normally be added to the BRAHMS Lookup List table. This means that users will have to select one of these values from the record verification form dropdown. If entries are not made here, users will be able to freely add their own status codes.

You can add as many status options as you like. To add or edit these, select Management > Lookup lists. Entries must be added here with the Field Name set to RecordStatus (case sensitive).

Example entries in the LookUp list table. Clearly the values added here are a decision for the database manager(s).
Adding and deleting verification records

In any open table, open the verification tool using the Verification History option on the Data Tools toolbar. The Verified By name (current user) cannot be edited. Select a Record Status and optionally add a comment – using Add Verification to add the record. Use Delete Verification to remove a verification entry.

A given record may have multiple verification records. Records are sorted with the most recent at the top of the list.

Reviewing verifications

The verification history for individual records can be seen by opening the Verification History tool window and moving through the data grid. However, to review all records with a verification entry, you can use the following procedure to tag records:

Open the Verification History tool and at the bottom of the form, select a 'Tag records having' setting. This may be records with 'Any Status' entry or it may be restricted to a selected Status code. You can choose the tag character to use, optionally clearing all existing tags beforehand.

An example where all records with a Map Error status code will be tagged with ‘!’
Records with map errors have been tagged with ! It is also possible to tag records that have different status codes using different tag symbols and thus record highlight colours.

Track and reverse changes

See examples on https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#edithistory

Introduction

All database changes, including those made in RDE files, are tracked in an edit history table. This feature tracks all record editing, who made the changes and when, together with the original and edited values. All changes, including those in long text strings, can be reversed using the Undo option.

By selecting the Edit History option, all edits for a record can be seen together.

Field level changes and undo

The Edit History form Field level tab lists the edits made to the current field. Here, you can use the Undo option to reverse edits – opting to go back as many stages as you have recorded.

Example Edit History screen showing the Field History tab. The Undo option is on the far right.
**Accessing the main edit history table**

All record additions, last edit dates and edits are centrally recorded in the Edit History table. To open the central edit history table, Select **Management > Edit History**.

An example screen with a column summary on the Record Type column. There are two categories of Action: Create and Update. In this screen shot, a grid filter has been set to show updates only.
Lookup functions

Introduction

Why use lookups?

Rather than typing in data values, wherever possible, an existing value can be selected from a dictionary or list already in your database. Why type in a species name when it’s been entered before? As well as speeding up data entry – this also helps to reduce typing error and enforce data standards.

In the ideal world, you would have as much clean and useful data as possible added to your database from the start. One of the challenges when creating a new database or optimising an existing one is locating and importing useful data – or tidying up your existing data and thus increasing its value.

In practice, your data dictionaries tend to grow over time, gradually becoming more valuable. In some cases, relevant data such as lists of taxa and places or the more obvious standard lists such as IUCN Red List status codes, can be imported from other sources, perhaps as exchanges with other BRAHMS projects. But in others, you can gradually develop lists and refine these as you go.

In summary, having well-organised tables of lookup fields and data values is an invaluable asset for healthy database development.

Two categories of lookup

There are two main categories of lookup used in BRAHMS:

a) selecting values from your larger database dictionaries such as people, taxa and place names. These tend to be large lists of names and as a rule, they have their own special lookup functions.

b) selecting values from your central lookup table/dictionary. This single table can hold lookup values for any database field that you have opted to register in your lookup dictionary. Examples are Habit, Language, Colour and Specimen Category. Much of this section focuses on this category of lookup and how to develop and manage your look up fields.

Activating a lookup

Firstly, you need to be in Edit mode. Once in Edit mode, you can activate a lookup using the F9 or Ctrl+L keys or by using the Lookup option on the Data Tools toolbar.

In edit mode, fields that have lookup functions are indicated with the lookup icon as shown here for the genus and author fields.

Fields that have values in your lookup table (see below) have a drop down menu added to the field.

If you are using a form, the lookup is activated by clicking on the relevant lookup button next to the field or by using a dropdown. Whether you have a dropdown or button depends on the field in question and also on the lookup field settings. For example, taxa and author names always have a button as these consult special lookup functions. Fields which are set to ‘append mode’ lookup (see below) will have a button allowing multi-value selections.
Lookups in the main dictionaries

The following give examples of how lookups are used to select values for or from some of the main taxa tables. There are other lookup tables which behave in the same way as the taxa examples given below. In a few cases, the options become slightly more specialised, a good example being author names for taxa. Author lookups are discussed in more detail in the Taxa section.

Family names

When looking for a family name, for example in RDE or in the main the genus table, typing in the Find box selects matching family names - pressing Enter selects the family at the top of the list and adds to your data table. Note that you can also use the yellow grid filter boxes. Choosing a family will also add ranks above the family name (Order and higher classification fields) if these are available.

Genus lookup – you can add a few letters of the family and genus to locate the name quickly.

When looking for a genus name, for example in RDE or in the main the species table, typing in the Find box selects matching genus names - pressing Enter selects the genus at the top of the list and adds to your data table. Note that you can also use the yellow grid filter boxes. Choosing a genus name will also add ranks above the genus name (Family and higher classification fields) if these are available. To optimise searching, you can add a few letters of the family and genus names. After some practice, you can learn to enter the minimum number of characters to reach the required record. Clearly, the more extensive the taxa dictionaries are, the more letters you will need to enter to select the correct record.
Species names

Species lookups – you can add a few letters of the genus and species epithets to locate the name quickly.

With species lookups, you can add a few genus and species epithet letters, experimenting with the optimal selection to get to required record. The right-side example is searching on the species epithet alone. Bear in mind that the yellow grid filters can also be used. As the species table is more complex than most, there are a number of other rules to consider to help locate names quickly, all requiring a little experimentation. As a rule you can enter any part of any name epithet to locate a name. If you are explicitly looking for a plant cultivar name, add a single quote before the name or part of the cultivar name.

As these data are hierarchical, if you know the species, it is not necessary to use a lookup in the family or genus field as the species lookup will add data to all these fields as well as higher classification.

Entering parts of name epithets, as shown above, can locate a name quickly

An example using a single quote to locate cultivar names starting with ‘whit’
Here some genus letters have also been added.

In this example [whit locates all name with trade epithet that includes [whit

The central lookup field list

Introduction

The central lookup list is used throughout the database and across all tables. Any field registered in the lookup list will be available in your system. In fact, the lookup list consists of two related tables, one storing the list of registered lookup fields with relevant settings for these fields – the other holds the actual lookup values.

The entries and values in your lookup lists entirely depend on what you want to add. While some of the entries and values will the same across projects and institutions (opening up scope to share useful lookup lists), individual projects manage their own lists.

To open and edit the central lookup field list, select Management > Lookup Fields.

The lookup Fields table stores a list of all registered lookup fields and provides a mechanism to edit their properties and to the lookup values. The Lookup table does not store lookups for taxa, places, collectors and data values for the other main tables as these already have their own special lookup functions.
Example entries in the lookup field list filtered on ‘threat’ – these are 2 of the fields used for conservation assessments.

**Description of the Lookup Fields table structure**

<table>
<thead>
<tr>
<th>Field name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag</td>
<td>Standard BRAHMS tag field.</td>
</tr>
<tr>
<td>Del</td>
<td>Standard BRAHMS deletion field.</td>
</tr>
<tr>
<td>#Field values</td>
<td>Calculated field: number of lookup values for a field.</td>
</tr>
<tr>
<td>Field Name</td>
<td>The name of the field.</td>
</tr>
<tr>
<td>Must Choose</td>
<td>User must choose one of the lookup values – no free text entry. If this option is not selected, the user can choose a value but also add a new value.</td>
</tr>
<tr>
<td>Must Choose in RDE</td>
<td>As above but applies only to the field when in an RDE file.</td>
</tr>
<tr>
<td>Use Append mode</td>
<td>Multiple lookup values can be selected.</td>
</tr>
<tr>
<td>Append separator</td>
<td>Separator between multi-values, e.g. , or ;</td>
</tr>
<tr>
<td>Not Nullable</td>
<td>Null values are not permitted – thus the user must select a non-null value. If this is not selected, the user can set a field to null.</td>
</tr>
<tr>
<td>Default value</td>
<td>If Null values are not permitted, a default value should be added.</td>
</tr>
<tr>
<td>Field Comments</td>
<td>General notes about a field.</td>
</tr>
<tr>
<td>Audit fields</td>
<td>Added when and by whom, last modified when and by whom.</td>
</tr>
</tbody>
</table>

The above listed field settings allow you to refine and control how users will use the lookup fields. Note that these settings can be controlled to allow different rules for the same field in the main tables and in RDE.

**RDE vs main table fields**

Field names used in RDE and in the main tables are the same. Thus if you register a lookup field for a main database table, if that field also exists in RDE, it will be automatically registered for RDE – and indeed any other table where the field is used. For example, the field Taxon Status, once registered for Species would be available in any other table where this field is used.

**Custom fields**

If you have a custom field, these are registered in a slightly different way and are discussed in the section below on *Editing lookups directly from the database tables*.

**Registering a new lookup field**

To add new field to your lookup list, select **Management > Lookup Fields** and use the **Add** option on the **Data Tools** toolbar.
Selecting a column to add to your lookup list.

- Select the **Type** value first. This tells BRAHMS which table you are listing fields from.
- Fields already registered are not listed in Add field **Column** dropdown.
- The same field may be used in multiple tables but it will only be registered once in the lookup list. Thus, the settings and values added for a given field will apply in all tables where that field exists.
- Only character fields are listed. Excluded are date, Boolean and numeric fields.
- Calculated fields are not available. It also excludes fields like Tag, Del and Audit fields.
- As a rule, do not add lookup lists for data values that already exist in their own table. This is further explained below. An example in the species file would be to add a lookup for Species or Species Author.

When you select a new field value, any existing values located in the newly selected field are listed on the form together a count of the occurrences of the values. You can use these existing values to help develop your lookup list - selecting some or all of the current values.

In the above example, the **LLORIGIN** field is not yet registered in the lookup list. The data column already has many values in the Collection Event table. These are listed here with a count of the number of occurrences per value. At this point, you could choose to some or all of these values to quickly develop the lookup list for this field. You can also add new values. Bear in mind that the existing values may include entries that you do not want to include in your clean lookup list. And in fact, any rogue values (e.g. spelling variations) ideally ought be edited in the data table at some stage.

Manually adding a new value to the lookup list. Another way to add new values to the list is discussed below.
The order of lookup values as presented when you are selecting a value is controlled by the Sort Order field. You can adjust this order on the values form using the Move Up and Move Down options.

### Field value table

<table>
<thead>
<tr>
<th>Field name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag</td>
<td>Standard BRAHMS tag field</td>
</tr>
<tr>
<td>Del</td>
<td>Standard BRAHMS deletion field</td>
</tr>
<tr>
<td>Parent value</td>
<td>Some lookup values exist in a hierarchy of values e.g. plant events</td>
</tr>
<tr>
<td>Sort order</td>
<td>The list order for the lookup values</td>
</tr>
<tr>
<td>Value</td>
<td>The lookup value itself</td>
</tr>
<tr>
<td>Value description</td>
<td>A description of the value</td>
</tr>
<tr>
<td># Values</td>
<td>Calculated field: number of values for the current field</td>
</tr>
<tr>
<td>Field Comments</td>
<td>Other comments</td>
</tr>
<tr>
<td>Audit fields</td>
<td>Added when and by whom, last modified when and by whom</td>
</tr>
</tbody>
</table>

### Deleting a lookup field

Entries can be deleted from the lookup list in the normal way – mark for deletion and then remove. When you delete a record, all associated lookup values are deleted.

### Which fields to register as lookup fields?

The decision on which fields to add to your lookup list is a project level or personal one. There are no hard and fast rules. However, fields that have a large number of value options, for example more than 1000 are unlikely to be good candidates. Also, although you can add a ‘notes’ field (e.g. Habitat Text) as a look up, as notes will almost always be different, you may not find this useful. However, if you have a common occurrence of some note values, you could selectively add these to the lookup list and then ensure that these can be edited in the table. However, bear in mind that presently, the max length of a lookup list value entry is 128 characters.

### Editing lookups directly from the database tables

Rather than editing the lookup fields and values from the Management menu, a convenient way to register and edit these values is when you are working in a data table. Here, you can use the Edit lookup values option on the Data Tools toolbar. A non-Admin user needs permission to do this.

This option a) lists all different values in the current column and b) lists the values currently available as lookup values. The option allows you to add or remove entries in your lookup list.

Use Edit Lookup Values to create or edit lookup lists when you are editing a data grid.
In this screen, here in an opened RDE file, the user has added a field called ‘My new field’. The lookup list editor shows that none of the entries in the field (Big, Medium, etc.) have been registered in the list. The Add or Add All options can be used to auto-register some or all of the entries in the current table.

Here, all the new entries have been registered. Using the right panel options, further entries can be added. After editing values, it is best to close and re-open the table to use the new lookup settings.

Importing lookup values

Look up values can be imported from Excel tables. Some tables are provided by the BRAHMS project for a range of data categories. But you can also develop your own lookup lists. For example, you may have lists of values for biomes, soil types, insect wing colours or flowering stages. Rather than adding these manually to your lookup list table, you can import them from existing Excel tables.

- To import values, select Management > Lookup Lists. Click on the Management menu again and select Import from Excel, locating your Excel file as prompted (XLSX files only).
When importing, ensure that minimally, you have the Field Name, Abbreviation and Value fields matched as shown above. The right screen shows the data in the Excel table ready to import.

Dropdowns in data grid and forms
As soon as you add any entries for given field to your lookup list – and you are in edit mode, the data field in the data grid and on the form displays as a dropdown rather than a free entry text box. Depending on the settings in your field list table, users will be forced to choose one or more values or also be able to type in new values.

In the left side example, no entries have been registered in the lookup list for Provenance Type. Hence the field can be freely edited. The right side example shows the field after one or more entries have been registered and the user is forced to select one of the dropdown options.

Multi-value lookups
If an appropriate field is set to Append mode, this means that you can select multiple values to add to the field. These will be separated by the designated separation character.
In Append mode, the lookup button assembles the existing values to a list box where they can be edited.
Adding custom fields

Introduction

BRAHMS databases and the tables they contain are provided with a defined structure. However, as well as choosing the data columns you see in your data grids, you can add new data fields specific to your project, selecting the field name, type and size. These custom fields become a permanent part of your database unless you subsequently opt to delete them. This also applies to RDE files.

Adding and editing custom fields

As an example, open the main species table or another table you may prefer. Select Grid Tools > Manage Columns. On this form, you have the option to add Custom Columns, choosing the field name, type and size.

If the field is of type Text and you set Max. Chars to NULL or 0, this creates a text field with no maximum length (equivalent to a v7 memo field). You can set the default position of these fields using the Up Down Top Bottom options.

Using the Editor tab options, you can list and remove custom fields for the current table.

Custom field data in grids and forms

Data in custom fields can be edited in the same way as all other fields. You can also add lookup lists.

Custom fields appear in your main data grids, assuming they are selected for inclusion in your data grid view. They have a different font to standard fields.

Where possible, custom fields can also be edited on forms.
**Viewing custom fields for all tables**

All custom fields from all tables are registered in a central table opened using Management > Custom fields.

![Central custom fields table snapshot](image)

**RDE files and custom fields**

In the case of RDE files, when you run the importer, the system checks for custom fields. If there are custom fields added to the RDE file and these are not already registered in BRAHMS, you are offered the chance to register from the RDE import wizard. If you do not register the field(s), the data in those fields will not be imported.
Rapid Data Entry

If you have not downloaded the sample RDE file RDE_Bolivia_JRIWood.zip, do this now, and open the zip to the folder Documents/BRAHMS/RDE.

Note: if you have problems seeing RDE files in your manager, refer to the RDE troubleshooting section.

Introduction

While data can be entered directly into BRAHMS, RDE is recommended for entering larger numbers of records and also as a first step when importing or transferring data from other software packages such as Excel. RDE files are entirely separate mini-databases linked to your main BRAHMS database.

As well as storing data, RDE files can store images and have the same functionality as your main database files to track and undo changes.

RDE is perhaps the most widely used BRAHMS component and databases are often built through the importing of different RDE files.

RDE data are stored in portable SQLite databases. Although RDE files appear and are used as one single table, behind the scenes, they in fact comprise several related tables which allow you to link images to the RDE records and also keep track of all edits. RDE file have a ‘.rde’ file extension. NB for BRAHMS v7 users, RDE files are now contained in one single file.

You can store data in one or more RDE files and use these data to create summaries, maps, reports, manage images, and in general, use many of the BRAHMS tools and functions. Some users continue to work in RDE as it does all they need. However, RDE files are more like Excel spreadsheets with BRAHMS features and a series of separate RDE files does not constitute a ‘database’. Data held in separate RDE files cannot be combined for reporting or mapping - unless the RDE files are merged into a single large file – a process which is possible but inefficient for long term data management. Most projects gather or add data to RDE files – and then transfer these files into their database.

Portable and flexible

RDE files are completely portable. They can be copied to any PC and/or exchanged with other users. You can store them on memory sticks and open the file(s) from there from any BRAHMS database.
An example of RDE files stored on a USB drive.

RDE files are also very flexible in that you can add new custom fields and choose default field views – exactly as you can in the main database tables.

**RDE file categories**

RDE files are available for different categories of data. Currently these include:

<table>
<thead>
<tr>
<th>RDE file category</th>
<th>Used for entering or transferring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gazetteer</td>
<td>Geographic data only – names of places.</td>
</tr>
<tr>
<td>Taxonomy</td>
<td>Taxonomic data only – names of all taxonomic ranks.</td>
</tr>
<tr>
<td>Specimens</td>
<td>Collection events including taxonomy, geographic data and fields for museum specimens.</td>
</tr>
<tr>
<td>Observations</td>
<td>Observations – collection events only. Note that observations can be added to specimen files leaving the physical specimen related fields blank.</td>
</tr>
<tr>
<td>Plant Accessions</td>
<td>Botanic garden accessions only.</td>
</tr>
<tr>
<td>Plants</td>
<td>Botanic garden accessions with extra fields for plant records derived from the accessions.</td>
</tr>
<tr>
<td>Plant Events</td>
<td>Botanic garden plant events – things that happen to plants over time, observations, inventory, checking, etc.</td>
</tr>
<tr>
<td>Entity Names</td>
<td>Adding plant entity data – yet to be documented.</td>
</tr>
</tbody>
</table>

This list is likely to be extended for other data categories.

**Managing RDE files**

The option Rapid Data Entry > RDE File Manager opens the RDE file manager. This table lists all the RDE files that you have access to. This will include files in your default storage folder Documents\BRAHMS\RDE and files in other RDE folders that have been registered and that you have access to.

A sample RDE manager showing files located in different folders.

Normally, you will create an RDE file for a particular task, for example, for logging data from a field trip, entering data for selected specimens, gathering data for a botanic garden inventory, etc. If working in a larger museum, your project may have numerous RDE files stored across different folders each of these with different access permissions.
Unlike v7, RDE files themselves do not have to be registered in the manager. Their presence in a registered RDE folder already ensures they will be listed. RDE files of all categories are listed together.

<table>
<thead>
<tr>
<th>Manager option</th>
<th>What it does</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toggle Archive Flag</td>
<td>Set Is Archived true/false</td>
</tr>
<tr>
<td>Hide archived files</td>
<td>Do not list archived files</td>
</tr>
<tr>
<td>Refresh List</td>
<td>Force update RDE list from your BRAHMS/RDE folder</td>
</tr>
<tr>
<td>Open</td>
<td>Open RDE file to view/edit (or double-click the file name in the manager)</td>
</tr>
<tr>
<td>Delete</td>
<td>Physically delete an RDE file</td>
</tr>
<tr>
<td>Edit</td>
<td>Edit details about the RDE file (meta data)</td>
</tr>
<tr>
<td>Copy RDE</td>
<td>Make a copy of an RDE file</td>
</tr>
<tr>
<td>Create RDE</td>
<td>Create a new RDE file of a selected category</td>
</tr>
</tbody>
</table>

**Registering RDE folders**

RDE files can be stored in any registered folder. New folders are added using the Add option of the left panel. Folders can use UNC paths or drive letters. Only project/database administrators have access to the folder management options. Administrators can also assign access permissions to one or more non-admin level users.

**Assigning user permissions to RDE folders**

All users with access to the RDE module, regardless of their database role, have access to their default Documents\BRAHMS\RDE folder. Beyond this, non-admin and non-manager users need to be given access to folder(s) by the system administrator or database manager.
To assign user access to an RDE folder:

- Ensure the folder is added to the RDE manager folder list. Clearly the folder has to be accessible to the user(s).
- Select the folder in the top part of the screen. Note that the default local Users folder cannot have user assignments. It always belongs to that user.
- At the bottom of the lower screen, use the drop-down to select users to add to the selected RDE folder. Only non-Admin users are listed. The drop-down may have a blank line at the top.
- You can provide many users access to the same folder.
- An Admin level user has access to all folders by default.

Creating new RDE files

When creating a new RDE file, you must first choose the RDE category from the list provided, provide a file title and optionally add any comments. When creating a file, you can opt to add blank records. Using the column manager, you can select the default columns to display and the column order.

You can also add your own custom fields if any fields you require are not available in the default list. Once you create the file, it will be added to the RDE manager list.

An example RDE folder listing various RDE files. Note that any valid RDE files in this folder will be auto-listed in the RDE manager. If you copy an RDE file and send to another BRAHMS user, it would then appear in their RDE manager list, as soon as they drop the file into their RDE folder.

When a new RDE file is created, the default folder will be Documents\BRAHMS\RDE unless a different folder location is selected.
Creating a new RDE file

Deleting RDE files

If an RDE file is deleted from your computer, it will auto-disappear from the manager list. If you use the BRAHMS delete option in the data grid, this will also delete the physical file from your computer.

RDE files can be deleted using the standard two-step delete function. But you can also delete the file from your PC using your file manager. RDE files moved to a non-registered folder will not be listed in the manager.

Opening and adding data to RDE

To open any RDE file, double-click on the file name or use the Open option on the RDE toolbar. As with all other tables, you need to switch to Edit mode to be able to edit the data. To optimise RDE entry, you will use your lookup up lists as described in the section Using and editing lookup lists.

It will also be useful to be familiar with the keyboard shortcuts as described in the section Grid navigation basics and keyboard and function keys.

In Edit mode, all data in the RDE file can be edited. Use the Edit History option to view and optionally undo any edits.
Quick Value Selection Tool

When you are in an opened RDE file which already has data added, you can use the Quick Data Selector tool to help add or update data values in the file.

Once opened, and you are in Edit mode, the tool lists all values in the currently selected column. These values are only listed from the current RDE file, not the main database.

- The Filter option on the Data Selector is used to locate the required value.
- Double-click on a value adds the value to the RDE field.
- Set the Clear filter option to clear filter when you move column/row.
- Auto-move to the next field or row after making a selection.

The Quick Data Selector tool can make working in RDE files more efficient. The data values listed auto-update as you move columns.

Importing to RDE from Excel tables

Video: [https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#lcexceltorde](https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#lcexceltorde)

Data and images can be imported from .xlsx tables into RDE using the Excel Data Import Wizard. This tool allows you to locate and open an Excel .xlsx file, then match the columns in the file to your opened RDE file. The matching between Excel and RDE columns can be adjusted as necessary to pull in as many fields as possible. This process also allows you to import data from custom fields – assuming the custom fields have been added to your RDE file. It also means that field names in foreign languages can be mapped to the standard names.

The above screens show the matching process and the data processed and ready to import to RDE.
The data now transferred into the RDE file.

**Excel to RDE field matching**

When importing data from Excel into an RDE file, BRAHMS has to know how to match your Excel columns to the correct fields in BRAHMS. For example, you may have a field in Excel with the column heading ‘Decimal Latitude’ that you want to go to the standard BRAHMS field ‘Latitude’. Or you may have a field in a different language such as the Portuguese ‘Pais’ or the Chinese ‘国家’ that you want to map to the BRAHMS column ‘Country’. The process of field matching is described in the section on Excel to BRAHMS field matching.

**Excel to RDE matching and transfer**

As well as append data to an RDE using the Excel to RDE importer, you can also add data to existing RDE records using the Match/Transfer function. For example, you may already have an RDE file with many records and then acquire some useful additional data you would like to add to this RDE file. As long as you can match the records in RDE to those in the Excel file, you can do this.

**Adding images to RDE files**

You can add one to many images to each record in your RDE file. Images can be dragged onto the standard image viewer or imported from Excel worksheets.

When importing from Excel, this will add one record per image to your RDE file. An example use is when digitizing data from specimen labels. Thus, a folder of specimen images (with label data) may be imported to an RDE file, the images can be opened in RDE, perhaps using a second monitor, and the data from the labels added to the file.

All aspects of image management including RDE related topics are discussed in the images section of this guide.

**Copying an RDE file**

To make a copy an RDE file, use the RDE Manager toolbar option Copy RDE. This option creates a copy of the file and it will auto-be added to your manager list. You can send an RDE file to another person.

**RDE file import analysis**

RDE file ‘analysis’ refers to the process of quality control, allowing you to assess data in your RDE file that are new to BRAHMS. This refers to the data that would be distributed to the various different BRAHMS tables as the RDE file is imported. Examples are family, genus, species and country names. The checks made depend on the category of RDE file you are working with.

Analysis make use of Boolean flags added to your RDE file – these flags can be switched on/off using the Show analysis flags on the main Rapid Data Entry menu. An analysis is run using the Analyse RDE file option.
In the above example for a specimen RDE file, the analysis flags are visible. As this is a specimen RDE file, there are many flags, one for each data field that will end up in a separate BRAHMS table. In the visible screen above, all the localities and three species are flagged as new entries (i.e. not in the database). Using the tick box in the yellow grid filter row, you can easily set filters to show just the new entries for any column or combination of columns.

While analysis flags do not need to be made visible, they are a useful guide to help with assessment of RDE data quality. As further discussed below, the analysis always takes place when you transfer an RDE to BRAHMS. Thus running a separate analysis is optional. Also, as discussed below, when importing to BRAHMS, a textual summary of the RDE table content is provided.

Transferring RDE files into BRAHMS

To import the RDE data into BRAHMS select **Transfer RDE to BRAHMS**. This opens the RDE Data Wizard. As a first step, if need be, you can optionally select **Restrict all import operations to tagged records**.

The first stage of the import runs the data analysis. As well as marking up the flags in the data grid as discussed above, it generates a report and activity log. The log can be saved to an Excel table.

The final stage runs the import itself. This stage adds the RDE data to the various main database tables, providing feedback as it proceeds. Large RDE files will take some time to process.
The final stage of importing transfers the data into BRAHMS.

A closer look at RDE files for collection events and preserved specimens

RDE files for specimens, be they animals, plants, fungi, microorganisms or any category of natural history data, share a number of features in common. This section lists a few points to consider when planning data entry.

RDE files for specimens are fundamentally collection event records storing the collector and field number; the collection date and place; the identification (albeit preliminary); and descriptive texts under various headings.

A record may be an observation or another type of entry with no physical specimens. In this case, the record will have no entry in the Institute code field. If the record has no entry in the Institute code field, it is considered to be simply a collection event record with no physical specimens. And if the file is transferred to BRAHMS, it will add collection event records – but it cannot add specimens.

Specimens and the Institute code

If the RDE file has a museum code (or equivalent) in the Institute code field, this implies that the collection event record has a physical specimen stored at that location. When these data are transferred to BRAHMS, the event will be added together with a specimen record. Certain fields in the RDE file are clearly part of the specimen record – rather than the collection event itself. These fields, any of which may not be available, include Specimen category, Barcode, Accession#, Folder and Box barcodes and several fields related to type status. Any of these fields, if added, would be stored in the specimen table – linked to the collection event itself. For more details about specimens and their determinations, refer to the section Collection events, Specimens and Determinations.

Adding multiple specimens per collection event

If you want to add multiple specimens per event at one time – for example, you have knowledge that the event resulted in several specimens (duplicates in the botanical world), you must copy the event record and then edit the Institute code for each different specimen. You may also know the specimen category, barcode and accession # for each specimen – and these data can be entered as available. Specimens may have type status (holotype, isotype, etc.) and, as discussed further below, may have more than one determination.

When the data are transferred to BRAHMS, only one collection event will be added. The event is recognised by the collector, field number, date, location and identification fields. If any of these are different, the system will add a separate collection event record. RDE records are easily duplicated down using Ctrl+F4 – then edited as required to change the fields that apply to the different specimens. You may have more than one entry for the same museum code.

In summary, when you import an RDE file, the system checks the data and populates the various related tables in BRAHMS. For example, if your RDE file includes a family name not already stored in BRAHMS, that family name would be added to the family table. Data can easily be edited in BRAHMS after import. However, as a rule, it is always better to try to remove the ‘big errors’ prior to importing, for example mis-spelt country, family or genus names.
Introduction

Living Collection RDE files are designed to batch add data for accessions and plants – and also to transfer data from other formats via Excel.

Although these files import in the same way as other RDE files, a number of special conditions arise. Living collection RDE files may include data for the accessions and also the plants themselves. Given that there may be more than one plant record per accession, the RDE file has to correctly link these data.

Create a new RDE file

To create a new RDE file, select Rapid Data Entry > RDE File Manager – then choose Rapid Data Entry > Create new RDE file... choosing the category ‘Living Collections’ and choosing a file name as prompted.

When you create a new RDE file for Living Collections, you can see there are a large number of potential fields that could be imported. These include data fields for the Accession itself and fields for plant records. These are all listed in the two images below.

When you create a new RDE file, you can set the default visible columns. Fields that are not visible are not removed from the file and can be made visible later on when you are editing the file. Once your new file has been created, it is auto-added to the RDE manager, ready to open and edit.

Select the columns you wish to use from the field list. Columns can be made visible later on if you decide you need them. Excluded columns are not removed from the file, only hidden. If you require a data field that is not provided in the list, you can add this as a Custom Column.
These RDE fields apply to the Accession part of the record including its wild origin. All fields except the Accession # itself can be blank.

These RDE fields are those that apply to plant records. If you are not importing plant data, these will be left blank. If you are importing plant details, all can be left blank except the Plant ID.

Section of an RDE file ready to be imported. Bear in mind, RDE files will only import the data you provide. Fields can be left empty or exclude from the visible columns.

**Import data from Excel to RDE**

If you have data in MS Excel to transfer to BRAHMS – this can be done using the Import from Excel option on the RDE menu. Refer to the rules for accession and plant numbering below.

This process is also described on the video:
https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#lcexceltorde
Manually adding data to an RDE file

Once you are Edit mode, you can freely add data to your RDE file. To speed up data entry, it is always useful to have as many lookup lists as possible in your database. Editing lookup lists is described in the section on lookups. Thus, rather than type in a value, you will be able to select it from a lookup function.

An example RDE file with data added.

Rules for accession and plant numbering in RDE files

In general, accession and plant numbering is controlled by your system format settings option for living collection accession numbering. In RDE files the following rules apply:

Accession numbering

1. If the Accession # is blank, it will not be imported.
2. If the Accession # field starts with ‘RDE’, this is a signal to the importer to auto-generate the next available number for the current database. The Accession #s must however be made unique, for example using ‘RDE1, RDE2, …’ or ‘RDE0001, RDE0002, …’, ‘RDEabc,…’ or as you wish.
3. On importing, the RDE Accession #s are converted to the numbering system assigned in your configuration setting. Thus ‘RDE1’ may be converted to ‘2019-00050’ and RDE2 to ‘2019-00051’.
4. If you add an Accession # entry lacking the text string ‘RDE’, such as ‘12345’ or ‘2019-100’, it will be added as entered, assuming it is new to the database. If it is not new, it is not added.
5. As described below, you can repeat an Accession # in the RDE file if you have multiple plants to import. Note, if repeating an accession entry (i.e. multiple plants), the accession details need only be entered in the first record.

Plant ID numbering

1. If the Plant ID field is blank, no plant record is added for the accession.
2. If the plant ID field is set to ‘*’, a plant record will be added for the current accession and the Plant ID will be auto-calculated using ‘2019-100*1’, ‘12345*1’, etc.
3. If the Plant ID is added as a string as in ‘0012345’ or ‘2019-50*1’, it will be added as entered, assuming unique.
4. If the Accession # is repeated in the RDE file, for example, there are 3 records all with Accession# ‘RDE0001’, and each record has Plant ID set to *, this would result in one accession record with 3 linked plant records.

Transfer all or restrict to tagged

Once your RDE file is ready and with the RDE file still open, select Rapid Data Entry > Transfer RDE to BRAHMS...
At this stage you can optionally restrict the transfer to tagged records.

After running the analysis which creates an import log which you can view/print, you can proceed as prompted by the Import Wizard to import the data.

The analysis reports on the status of your RDE file import. In this example, everything in the above list is new to the database and will thus be added to the relevant dictionary.

The complete import history for a given RDE file can be viewed form the RDE manager after the RDE file is closed.

Images in RDE files

Linking images

You can link 1:many images to each record in RDE. Images can be stored in any accessible folder. Images are viewed and linked using the Images option on the Data Tools toolbar. This opens the Linked Image Viewer.

Images can be dragged onto the viewer – or you can use the Link option provided. The images and the image link details are stored in separate tables in the RDE file. Bear in mind that behind the scenes, RDE files are in fact mini databases with several related tables.
As discussed in the section [Images from Excel](#), images can be imported from Excel along with other data.

An RDE record with a linked specimen image and another record with 2 habit images.

**Importing images from a selected folder**

If you have a folder of RDE images, you can import these to an opened RDE file – creating one new record per image in the selected folder.

To append images from a selected folder, use the **Import Images** option on the **Rapid Data Entry** toolbar.
Example: opening an RDE file, mapping and printing labels

Video: [https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#labelstoppt](https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#labelstoppt)

Reporting in BRAHMS provides almost limitless power to generate lists, labels, charts, cross-tabs and more. You can print reports directly from BRAHMS or send the outputs to documents, excel, pptx and elsewhere.

You are encouraged to experiment with report design and you can also open and use a sample provided for printing basic museum labels. Clearly, each institution has label design preferences, hence, it will be necessary to learn how to use the report designer.

This example opens an RDE file of specimen data prepared by J.R.I. Wood (Oxford) from his field work in Bolivia. To proceed with this task:

- First download the file [RDE_Bolivia_JRIWood.zip](https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#labelstoppt) and open the zip to the folder Documents/BRAHMS/RDE. The zip file includes an RDE file of specimens and a report template sample for labels.
- Log onto BRAHMS – choosing any project and select Rapid Data Entry > RDE File Manager. This will list any RDE files located in your BRAHMS\RDE folder.
- To open the RDE file, double-click on the RDE manager entry ‘John Wood Collections 2018’.
- Explore this RDE file using the Column Summary option on the Data Tools toolbar and, optionally, you could design a Tree View.

![An example Tree View designed to show geographic data including locality notes.](image)

- To map the file, select Mapping > ArcGIS in BRAHMS. Initially, if no records are tagged, no points will be plotted. To map the entire file, remove the mark from Tagged only on the map toolbar.

![The RDE file mapped with the Tagged only option de-selected.](image)

The RDE file mapped with the Tagged only option de-selected. If you now tag some records, you can use that option to restrict the map to tagged.

To produce some labels, you will need to tag some records as the reporter only works with tagged records. If you wanted to print labels for the entire file, use the Tag all option on the Tag dropdown – otherwise manually tag some records.
To open this report, select Reports then File > Browse and locate the report file ‘RDE specimen labels.mrt’ which was provided in the zip file downloaded above.

To view the labels, select the Preview tab.

On the Preview tab, you can choose various output options including MS Word. If exported to MS Word etc., your labels can be edited prior to printing.

If you wanted to explore reporting options more fully, you could now select File > New and choose one of the report wizards such as standard report wizard. In no time, you can create a new report template such as the one shown above.
Example: importing taxa from Excel or IPNI to RDE and BRAHMS

This exercise demonstrates how you can pull in a list of taxon names from Excel or IPNI to RDE – and then transfer these data into a BRAHMS database. The exercise starts with an import from IPNI (International Plant Names Index) but you can substitute the IPNI approach with an Excel file as discussed in the next task.

- While logged in to any database, select Rapid Data Entry > RDE File Manager.
- Again, select Rapid Data Entry and choose Create RDE … be sure to choose the category ‘Taxonomy’ and giving the RDE file a suitable title.
- You can adjust the default columns or add new ones if needed but otherwise, proceed to Finish to create the new file using the defaults.
- Open the file (double-click your new entry) and from the Rapid Data Entry toolbar, select Import Data from IPNI.
- Enter the name of a genus at the IPNI prompt (or a different search criterion as needed) - then Search.
- Once the name list is assembled, select Import BRAHMS records to RDE. There will be a delay as the data are transferred into the RDE file – if you have a lot of records, this may take some time.

Showing the data searched using IPNI for the genus Vatica - and then transferred to RDE.

The next stage, should you wish to do so, is to transfer these RDE data into your database. Normally, before doing so, the data would be checked and edited appropriately. This is one of the functions of RDE. If you are logged into the Conifer demo, you can import the data there.

- With the RDE file opened, select Rapid Data Entry > Transfer RDE to BRAHMS. You can use the option Analyse RDE file first but in fact, the analysis always takes place when you run the transfer option.

After running the Data Analysis, you can review the Import Report and apply filters as here showing subsp. This indicates these records are new to BRAHMS.

The import log includes more detail and can be saved to a text file.
Before deciding to transfer the RDE file into your database, you can also use the option **Show analysis flags** on the RDE menu. This displays a series of Boolean flags indicating the status of the data about to be imported. If a record is ticked, this means it’s a new entry. You can set filters on these flags using the grid filter bar.

The RDE analysis flags indicate the same information provided in the report with new entries flagged up in the various tick boxes. You can use the grid filter row to set filters, for example, to show new families.

Once satisfied the data are good to go, you can then Select **Next** on the import tool and select **Run** to Import the data.

Showing the data now added to the main species table, here sorted by Created on.
Example: importing your own sample data using RDE

Video: https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#importingfromexcel

This exercise encourages you to work with your own data, perhaps a list of taxa or better still, some specimens. These may be animal or plant data, whatever you have. The task is to transfer these from an Excel XLSX table into a BRAHMS Rapid Data Entry (RDE) file. Your data can be for any of the categories currently listed in the RDE manager when you create a new RDE table.

- Select **Rapid Data Entry > RDE File Manager**.
- Click again on the Rapid Data Entry menu and then choose **Create RDE ...** choosing the appropriate category. If you want to add collection data, this will be **Specimens**. Give your file a Title such as **Field trip 2018** or **My Orthoptera collection**.
- On the next step of RDE file creation, you choose the default fields to display in the RDE file. You can also add custom fields using Custom column Editor on the left part of the screen. You can alter the default field order at this stage using the Move column options (clicking to the left side of the field to move to activate this).

![Custom columns to a new RDE file. Note that setting the char size to 0 for a text field create a max length character field.](image)

If you now double-click on your RDE file, it will open as an empty file.

![The yellow row at the top of this empty RDE file is the grid filter bar - not used for data entry.](image)

At this stage you can switch to Edit mode and manually add records. But in this example, we discuss how you can import data from an XLSX file. The next steps assume you have some data in a XLSX file to import. We recommend at this stage that your XLSX file has a maximum of about 1000 records for testing.

On the Rapid Data Entry menu, select **Import from Excel...**. This opens the Excel import wizard. You can select the XLSX file and then match the columns between your XLSX and your RDE files.
As an example, the RDE file includes a field Latitude which is matched to a field LAT in the XLSX file. By matching the fields, you will import the data correctly. Where fields have the same names, they should be auto-matched.

Of course, the data have to be broadly in the correct format before transferring to RDE. For example, collection event dates are stored in the 3 numeric fields Collection Day, Collection Month and Collection Year. So, if your XLSX file has this in a date field, you would need to convert the data to 3 numeric fields first. Also, for mapping, map data in the Latitude and Longitude fields should be decimal format and negative for South and West.

Troubleshooting

If you have old versions of RDE files (data structures out of date) within your RDE folders, these may prevent you from seeing any RDE files – including new ones. In such cases, please delete the old RDE files and the new RDE will appear in your RDE file view. Old RDE files may have been created in a testing phase.
Mapping your data

Introduction
Mapping options include dynamic links to the in-built ArcGIS and externally, by passing data to ArcGIS, Google Earth, DIVA, QGIS and GeoCAT.

You can map your data directly from BRAHMS as long as the data table includes the equivalent of Latitude and Longitude fields. Currently, this applies to all collection events, the botanic garden plant tables and the equivalents of these in RDE tables. Mapping options are provided as follows:

<table>
<thead>
<tr>
<th>Map option</th>
<th>Installation required</th>
<th>Must be online</th>
<th>Base maps required</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRAHMS ArcGIS API</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>ArcGIS / ArcMap</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>QGIS</td>
<td>Yes free</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Diva GIS</td>
<td>Yes free</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>GeoCAT</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Google Earth</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Download details for any required software and base maps are provide below.

The choice of mapping tools depends on your objectives. For example, the built-in ArcGIS API is especially good for viewing and editing data, locating errors, map searches, certain calculations, and creating map images that can be added to reports. If your objective is to produce high quality maps for publication, you will likely choose QGIS, Diva or AcrGIS. Links to Google Earth are being developed mostly for analysis. GeoCAT is used to calculate EOO and AOO.

The main mapping changes in v8 (coming from v7) are the addition of the in-built ArcGIS API; the map location editor tools; and that all map point data are stored only in decimal degree format. Data entry in different units is reviewed below.

Map points
All map points for latitude and longitude are stored in decimal degree format with negative values for South and West. We no longer use the v7 NS and EW fields. However, as with v7, you can choose to add data in Degree Minute Seconds (DMS) Decimal Degrees (DD) or Decimal Minute (DM) format. Point data can be entered to 10 decimal places. The resolution of points can be stated using the coded LLResolution field. These codes can be used to select map points and also to control the format of calculated map text strings.

Mapping related fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latitude</td>
<td>Latitude of the point</td>
</tr>
<tr>
<td>Longitude</td>
<td>Longitude of the point</td>
</tr>
<tr>
<td>LLResolution</td>
<td>Coded resolution of map data ranging from 1 to 8 (optional)</td>
</tr>
<tr>
<td>LLOrigin</td>
<td>Coded origin of map data (optional)</td>
</tr>
<tr>
<td>LLDatum</td>
<td>Geodetic Datum value e.g. WGS84, NAD83</td>
</tr>
<tr>
<td>QDS *</td>
<td>Quarter Degree Square value e.g. 2830CB</td>
</tr>
<tr>
<td># DGMS</td>
<td>Calculated field for labels e.g. 16° 19' 59.998&quot; N, 96° 35' 59.999&quot; W</td>
</tr>
<tr>
<td>Tag</td>
<td>Standard BRAHMS field – but can be used to control which records are plotted</td>
</tr>
</tbody>
</table>
Sources of vector and raster base maps and other map layers

There are numerous sources of map data available on the internet. [http://www.diva-gis.org/Data](http://www.diva-gis.org/Data) has numerous layers with global coverage. Excellent raster and vector maps are also available on [http://www.naturalearthdata.com/features/](http://www.naturalearthdata.com/features/).

Global raster and vector map data are freely available on [http://www.naturalearthdata.com/features/](http://www.naturalearthdata.com/features/) and [http://www.diva-gis.org/Data](http://www.diva-gis.org/Data) as well as on many other sites.

You do not need to download base maps and layers if you are using the in-built BRAHMS ArcGIS mapper, Google Earth or GeoCAT.

Thus as an example, if you wanted a vector (line) map for the world country outlines, you can visit [https://www.naturalearthdata.com/downloads/](https://www.naturalearthdata.com/downloads/) and choose Cultural (large scale data for the most detailed map) and download the Admin – O Countries file. There are many types of base map available for download under the cultural, physical and raster sections and you can pick and choose as relevant.

Once any downloaded data are extracted (always a good idea to organise your base map data in well organised folders), you can use these data to draw layers in *e.g.* QGIS or Diva. Examples are provided in the relevant sections below.

Adding and editing map points

**Introduction**

The map location editor can be used in RDE and in the main tables for collection events and botanic garden plant points. This can be tested in the RDE file opened above. You can use the map location editor to add a new map point or edit an existing one. You need to be online to use this feature in BRAHMS.

The editor opens an online map form which updates as you move through the data grid. Records with existing Latitude and Longitude points will be mapped using a single point on your selected base map. A right-click on the map resets the point position and either auto-saves this to the grid or awaits conformation with via the Save option.

Although data in BRAHMS are always stored in decimal degree format, you can manually enter data in degrees minutes and seconds or in decimal minute formats. However, the ability to select or edit the point on the map reduces the need to type in data.
Opening the map point editor

To open the map point editor, you can either use the standard lookup in the Latitude or Longitude fields or alternatively, use the Map point editor option on the map toolbar. This latter option can be used from any field in the current record. It does not require you to be in edit mode although you do need edit rights.

Once opened, the location editor can be used to edit points and altitude in your data grid.

The map location editor displaying the current point, set to Auto-save. In this mode, a right-click on the map will update the Latitude and Longitude values in the data grid without using the Save option. This screen has no zoom and is displaying the entire globe.

The same point displayed at very different zoom levels.
Location editor settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base map</td>
<td>Choose base map that best suits the editing task in hand.</td>
</tr>
<tr>
<td>Auto-zoom on/off</td>
<td>If selected, as you move to different records, the map zooms to the current point using your zoom scale setting.</td>
</tr>
<tr>
<td>Zoom marker</td>
<td>Zoom to current point based on your Zoom Scale setting.</td>
</tr>
<tr>
<td>Zoom Scale</td>
<td>Choose the optimal zoom setting. Maximum shows a world map.</td>
</tr>
<tr>
<td>Reset Zoom</td>
<td>Reset the zoom, if adjusted, to your current setting.</td>
</tr>
<tr>
<td>Map units</td>
<td>Select the entry mode for manually editing data.</td>
</tr>
<tr>
<td>Lat Long checked</td>
<td>Mark a record as ‘map checked’.</td>
</tr>
<tr>
<td>Auto-save</td>
<td>If selected, a right-click on the map will adjust the point and save the map point change.</td>
</tr>
</tbody>
</table>

Selecting the optimal zoom level

The optimal zoom level will vary from task to task. You can adjust zoom by double-clicking the map, using your mouse wheel or using shift + drag box around the area of interest. The speed of screen update depends on the number of map tiles the system needs to download. As a rule, the closer you zoom in, the slower the system will respond as you move to new records. Also note that different base maps influence speed. Some experimentation is needed to check the optimal settings.

Sorting by collection date or by latitude + longitude

If you sort the data grid by collection year then month then day, you can then scroll down the data grid to follow a collector’s itinerary. This can be a useful way to resolve collection locations and field number sequence errors.

If you sort the data grid by latitude ad longitude, as you scroll down the grid, the points will follow the geographic sort.

Map using the ArcGIS API

See examples on [https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#mapping](https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#mapping)

Video: [https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#mappingvideo](https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#mappingvideo)

Video: [https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#gardenmapping](https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#gardenmapping)

Introduction

The in-built ArcGIS API provides a wealth of handy mapping features which you can take advantage of without installing any further GIS software. However, you do need to be online. Some advantages of the in-built ArcGIS tool:

- No installation required;
- data points are highlighted on the map as you browse through your data grid;
- clicking on a map point locates the grid record, an excellent way to locate errors;
- maps are auto-updated as you apply grid filters;
- calculation of Extent of Occurrence (EOO);
- selectable base map including world imagery;
- map tagged only or map all, exclude cultivated records;
- apply map point colours based on tag colours;
- search maps;
- save map as a png file and import to a document.
Preparing some sample distribution maps

- Select **Collections > Collection events** then select the **Mapping** toolbar followed by **ArcGIS in BRAHMS**. If no filter is applied, by default, this will plot all tagged records. To plot records, tagged or not, adjust the **Tagged only** option. The map window can be dragged to another monitor and made full screen size.

A map displaying all conifer collections (no filters applied). The setting here does not restrict to tagged records and a dark gray base map is selected. The current record (Kenya) is highlighted on the map.

Here, a filter set on New Zealand with the base map set to World imagery, The point colour has been changed and the current grid record is highlighted.
In this example, the collection events are docked below the species table which is set to show accepted names only. The Taxa menu **Link Grids** option has been selected. Thus, moving to a new record in the species grid will update the collection events and the map.

An example using the main query tool to define a rectangular grid area. This is a useful way to save a commonly used search similar to ‘grid box’ searches in version 7.

This example, taken from The Morton Arboretum database, shows gardens plants filtered on Plant Status = ‘A’ (Alive) and Planted Year before 1995. The Column Summary shows the number of plants per taxa.
Map searches

Using the **Draw search area** option on the Map toolbar, you can drag a search area and then use **Search drawn areas** to apply the search filter.

This example shows a map searched directly using the search tools. The data grid is updated accordingly. The **Column Summary** tool, here docked left, is displaying the number of collection event records per taxa within the selected area.

Map Auto-Zoom

By default, maps will zoom to display the boundaries of the selected data points. However, it can also be convenient to disable Auto-Zoom to be able to display species distributions on a fixed area.

With the ArcGIS **Auto Zoom** disabled, you can plot different taxa without changing the current base map area.
Map point colours

You can respect record tag colours by selecting the Use Tag Colours option on the map itself. Tag colours can be defined from System > Options > Tag Highlight Colours.

Locating and editing map errors – some hints and tricks

Most museum or garden databases with geo-referenced data include errors. Map data errors have many potential causes and correcting these is often a priority for projects.

The above map is from a gathering of data mostly from Brazil. The errors look a lot worse than they are as the vast majority can be fixed by simply adjusting the north-southing and/or the east-westing of the points. This would be done by ensuring any points known to be ‘west’ have negative longitude value.

a) Set a filter
b) Use a map search plus SQL command
Setup for ArcMap, QGIS, DIVA

While BRAHMS does its best to locate these programs in your computer registry, some installation locations are harder to find. Thus you can explicitly link the start-up exe or bat files for these GIS packages.

Select **System > Options > Mapping** to hardwire the locations of the start-up files.

**Setting GIS start-up locations.**

**Mapping using ArcMAP**

**Introduction**

If you are an ArcGIS/ArcMAP user and have this software installed on your local PC or network, you can connect from BRAHMS, passing data to new or existing map projects. As discussed below, assuming the BRAHMS data output file is added as a data layer in your project, the map points will be added to your map dynamically.

**Map points and the arcmap_data.csv file**

Map points in BRAHMS are stored in main collection events file, the living collections table and in the main gazetteer - together with other map related fields. When you create maps, the relevant data from all tagged records are used to create the csv file **arcmap_data.csv**. As discussed below, this file can be included in your map project.

The **arcmap_data.csv** file includes fields gathered from BRAHMS, these depending on the category of data being mapped.

A selection of the fields available in the arcmap_data.csv
**Fields passed to ArcMAP**

The full list of fields passed to ArcMAP when mapping **collection events**:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record ID</td>
<td>GUID for exported BRAHMS record</td>
</tr>
<tr>
<td>Collector</td>
<td>Name of collector(s)</td>
</tr>
<tr>
<td>Field Number</td>
<td>Collection event number</td>
</tr>
<tr>
<td>Day</td>
<td>Day of collection</td>
</tr>
<tr>
<td>Month</td>
<td>Month of collection</td>
</tr>
<tr>
<td>Year</td>
<td>Year of collection</td>
</tr>
<tr>
<td>Family</td>
<td>Family name</td>
</tr>
<tr>
<td>Genus</td>
<td>Genus name</td>
</tr>
<tr>
<td>Species</td>
<td>Species name</td>
</tr>
<tr>
<td>Subspecies</td>
<td>Subspecies name</td>
</tr>
<tr>
<td>Variety</td>
<td>Variety name</td>
</tr>
<tr>
<td>Forma</td>
<td>Forma name</td>
</tr>
<tr>
<td>Cultivar</td>
<td>Cultivar name</td>
</tr>
<tr>
<td>Country</td>
<td>Country for the collection event</td>
</tr>
<tr>
<td>Major Area</td>
<td>Major admin division</td>
</tr>
<tr>
<td>Minor Area</td>
<td>Minor admin division</td>
</tr>
<tr>
<td>Locality Name</td>
<td>Locality name</td>
</tr>
<tr>
<td>Locality Notes</td>
<td>Locality notes</td>
</tr>
<tr>
<td>Elevation</td>
<td>Elevation in m</td>
</tr>
<tr>
<td>Latitude</td>
<td>Decimal latitude</td>
</tr>
<tr>
<td>Longitude</td>
<td>Decimal longitude</td>
</tr>
<tr>
<td>LLres</td>
<td>Map resolution (usually coded)</td>
</tr>
<tr>
<td>LLorigin</td>
<td>Origin of map data</td>
</tr>
<tr>
<td>LLDatum</td>
<td>Geodetic datum</td>
</tr>
<tr>
<td>QDS</td>
<td>Quarter Degree Square value</td>
</tr>
</tbody>
</table>

*Further fields can be added on request.*

The full list of fields passed to ArcMAP when mapping **living collections**:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record ID</td>
<td>GUID for exported BRAHMS record</td>
</tr>
<tr>
<td>PlantID</td>
<td>Plant ID</td>
</tr>
<tr>
<td>Living Status</td>
<td>Plant status</td>
</tr>
<tr>
<td>GardenLocation</td>
<td>Garden location name</td>
</tr>
<tr>
<td>Grid</td>
<td>Grid code/number</td>
</tr>
<tr>
<td>Subgrid</td>
<td>Subgrid code/number</td>
</tr>
<tr>
<td>GardenBed</td>
<td>Bed code/number</td>
</tr>
<tr>
<td>PlantYear</td>
<td>Year of planting</td>
</tr>
<tr>
<td>PlantMonth</td>
<td>Month of planting</td>
</tr>
<tr>
<td>PlantDay</td>
<td>Day of planting</td>
</tr>
<tr>
<td>Family</td>
<td>Family name</td>
</tr>
<tr>
<td>Genus</td>
<td>Genus name</td>
</tr>
<tr>
<td>Species</td>
<td>Species name</td>
</tr>
<tr>
<td>Subspecies</td>
<td>Subspecies name</td>
</tr>
<tr>
<td>Variety</td>
<td>Variety name</td>
</tr>
<tr>
<td>Forma</td>
<td>Forma name</td>
</tr>
<tr>
<td>Cultivar</td>
<td>Cultivar name</td>
</tr>
<tr>
<td>CommemorationCategory</td>
<td>Commemoration category</td>
</tr>
<tr>
<td>NeedsLabel</td>
<td>Plant marked for label requirement</td>
</tr>
<tr>
<td>Latitude</td>
<td>Decimal latitude</td>
</tr>
<tr>
<td>Longitude</td>
<td>Decimal longitude</td>
</tr>
<tr>
<td>LLres</td>
<td>Map resolution (usually coded)</td>
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<tr>
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<td>LLDatum</td>
<td>Geodetic datum</td>
</tr>
<tr>
<td>QDS</td>
<td>Quarter Degree Square value</td>
</tr>
</tbody>
</table>

*Further fields can be added on request.*
Record ID and data editing

The Record ID is the GUID identifier of the record in BRAHMS. This means that selected data can be edited using GIS tools and then transferred back to BRAHMS, updating the table accordingly. For example, you may have used some tools you have added to or developed in ArcMAP to check and adjust map points. By exporting the revised Latitude Longitude points together with the GUID, you can then easily update your database using the Match/Transfer tool. This would equally apply to data returned from a hand held device.

Opening a new or saved ArcMAP project

To open ArcMAP, use the ArcMAP option on the Maps toolbar. Note that this option will not be enabled if you have selected Tagged Only and no records are tagged. Mapping output will respect filters. Thus you can set a filter (in the example below a country name) and/or restrict to tagged records.

The ArcMAP option will not be enabled if you have selected Tagged only but have no tagged records.

Left. Opening ArcMAP with no project selection. Right. Selecting an existing project.

Here, an existing project has been opened and using the Add Data option on the ArcMAP toolbar, the BRAHMS output file arcmap_data.csv is located. Note that you may need to register this data folder so that ArcMAP can locate your csv data file.
At this stage, you could open this table by right-clicking on the csv and select **Open**. The next step is to correctly register this csv data file as a map layer. To do this, right-click on the csv and select **Display XY Data**.

Ensure the Longitude and Latitude fields are correctly selected. Using the Edit option, set the Geographic Coordinate System as required – the default used by BRAHMS is World WGS 1984.
With arcmap_data.csv correctly registered, the point data passed from BRAHMS with automatically update when a new map is produced.

The above map produced from the Red Butte Garden database was created by applying a filter to their garden locality named ‘Floral Walk’ and plotting directly to ArcMAP.
Mapping using QGIS

Introduction

QGIS is a mapping package – freely available on [https://www.qgis.org/en/site/](https://www.qgis.org/en/site/) (or just search for QGIS). BRAHMS can connect and pass data to QGIS – but you have to install the QGIS software locally first.

Map points and the qgis_data.csv file.

Map points in BRAHMS are stored in main collection events file, the living collections table and in the main gazetteer - together with other map related fields. When you create maps, the relevant data from all tagged records are used to create the csv file qgis_data.csv. As discussed below, this file can be included in your map project.

The qgis_data.csv file includes fields gathered from BRAHMS, these depending on the category of data being mapped.

Fields passed to QGIS

The fields passed to QGIS are the same as those passed to ArcMAP. Refer to the section on Fields passed to ArcMAP.

RecordID and data editing

The Record ID is the GUID identifier of the record in BRAHMS. This means that selected data can be edited using GIS tools and then transferred back to BRAHMS, updating the table accordingly. For example, you may have used some tools you have added to or developed in QGIS to check and adjust map points. By exporting the revised Latitude Longitude points together with the GUID, you can then easily update your database using the Match/Transfer tool. This would equally apply to data returned from a hand held device.

Opening a new or saved QGIS project

To open QGIS, use the QGIS option on the Maps toolbar. Note that this option will not be enabled if you have selected Tagged Only and no records are tagged. Mapping output will respect filters. Thus you can set a filter (in the example below a country name) and/or restrict to tagged records.

The QGIS option will not be enabled if you have selected Tagged only but have no tagged records.

Left. Opening QGIS with no project selection. Right. Selecting an existing project.
Having opened a new project and added a map layer (here a global raster map), the next step is to add the data points layer as exported from BRAHMS in the qgis_data.csv file.

To do this, select Layer > Add Layer > Add Delimited Text Layer. Here you can locate the file qgis_data.csv. The X and Y fields should pick up Longitude and Latitude.

Once added, you can save the project with the registered data layer.

Once the csv file has been registered, any new map you plot from BRAHMS using the saved project will display the points from the supplied csv file.
Mapping using Diva GIS

If you have diva installed (www.diva-gis.org/download), you can plot maps there using the same procedures used in v7. Unlike QGIS, it is not possible to pass and plot the map points directly. Instead, after opening Diva, you need to pull in the map points as discussed below.

Once Diva is opened (you may have chosen a saved project with existing map layers):

Add the map layer(s)

- In DIVA, select Layer > Add layer and locate a .SHP file to plot.
- Select one or more vector or raster SHP files.
- To select a different area on your base map, use the toolbar and drag a rectangle on your map. This can be done at any stage.
- To change the properties of a map layer such as the thickness of the map coastline, double-click the small map layer rectangle in the left DIVA margin and then dbl-click the small rectangle on the resulting properties form and set the layer properties as prompted. Note that these actions can be carried out on any layer listed in the left margin.

Add your map data points as a layer

- To add your map data, select Data > Import points to Shapefile > From Text file (TXT).
- Click on the Input file option and locate the map file that you created above. The default input map name is divagis_data.txt located in your Documents/BRAHMS folder. The field delimiter is a comma.

Once you are at this stage, select Apply on the Diva form and your points will appear.

Mapping to Google Earth and GeoCAT

Assuming you have installed Google Earth on your PC, you can plot map directly using the option on the Mapping toolbar. GeoCAT is online and requires no installation. As with other mapping options, be sure that the Tagged only option is set as needed.
Mapping to Google Earth

The species Pinus balfouriana plotted from the demo conifer database. Clicking on the data points displays selected field values.

Mapping to GeoCAT

The species Pinus balfouriana plotted to GeoCAT from the demo conifer database.
Image management

See examples on https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#images

Introduction

Images can be linked to any record in BRAHMS. You can link multiple images to the same record. Information about your images is listed in the central images table. For example, images could be linked to species, entities, collection events, specimens and living plants. However, you may also consider linking images to people, places, garden locations, other taxa ranks such as families and genera, in the latter two cases, these would be representative images.

The images themselves may of any image file type – and may be registered in BRAHMS as physical file paths or as URL links. If a registered image cannot be located, the system will be unable to display it. Typically, images are of preserved specimens (insects, herbarium, fossils), illustrations and habit shots such as garden or wild collected plants/animals. But equally, they may be images of maps, people, landscapes, etc.

The links between images and data records in BRAHMS are maintained in a separate table which is not one you can open. This table holds the GUIDs of the image records and the GUIDs of the data records to which the images are linked.

Images can be viewed from the main image table itself file, clearly one image per record, and/or from any other table where records have image links.

Viewing images

The image viewer is opened from any BRAHMS or RDE table using the Images toolbar option on Data Tools.
If any images are linked to the current record, these will be displayed in the viewer with thumbs in the lower part of the form.

The image viewer has a number of controls below the main image:

Options, left to right:
- Flip image horizontally, Flip image vertically
- Rotate left 90 degrees, Rotate right 90 degrees
- Reset
- Open image in your default image viewer
- Fit content within bounds
- Fill bounds with content

Image viewer function keys:
- Shift + Mouse Wheel: zoom
- Ctrl + Mouse Wheel: pan
- Alt + Mouse Wheel: drag rectangle to zoom

There is also a zoom/pan image explore option:

The slightly obscure icon bottom right is used to open the View Finder. This provides a zoom/pan image explore option.

The View Finder in use.

Manually linking images
Images can be linked to or unlinked from any record in BRAHMS when using the Image Viewer. As an example, linking images to a species record:

- Select Taxa > Species and then on Data Tools, select Images... to open the Image Viewer.
- Here, you can either use the Link button or drag image(s) to the Image Viewer.
To link images to a record, you can drag the image (or images) from your file manager onto the BRAHMS Image Viewer.

Alternatively, use the **Link** option at the bottom of the image form. Use **Unlink** or **Unlink all** to remove the link(s).

### The main image library

The main image table in BRAHMS is opened using **Images > Image Records**. Images themselves are never added to your database, inflating its size. The image table only stores references and meta data about the images.

<table>
<thead>
<tr>
<th>Field name</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image file</td>
<td>The file name of the image</td>
</tr>
<tr>
<td>Directory</td>
<td>The folder location of the image file</td>
</tr>
<tr>
<td>Image URL</td>
<td>The full URL of the image</td>
</tr>
<tr>
<td>File Type</td>
<td>The type of image file</td>
</tr>
<tr>
<td>File Size</td>
<td>The image file size</td>
</tr>
<tr>
<td>Image Type</td>
<td>User defined classification of your images (scan, painting, illustration, etc.)</td>
</tr>
<tr>
<td>Image Caption</td>
<td>Free text</td>
</tr>
<tr>
<td>Foto Prefix</td>
<td>Used to further reference an image source</td>
</tr>
<tr>
<td>Foto Number</td>
<td>Used to further reference an image source</td>
</tr>
<tr>
<td>Foto Suffix</td>
<td>Used to further reference an image source</td>
</tr>
<tr>
<td>Priority</td>
<td>Numeric value to indicate image priority within your project</td>
</tr>
<tr>
<td>Image Date</td>
<td>Date image taken</td>
</tr>
<tr>
<td>Copyright</td>
<td>Free text</td>
</tr>
<tr>
<td>Not Online</td>
<td>Yes/No field to optional prevent uploading</td>
</tr>
<tr>
<td>Comments</td>
<td>Free text</td>
</tr>
<tr>
<td>Uploaded to BOL by</td>
<td>Who uploaded image to BRAHMS online</td>
</tr>
<tr>
<td>Uploaded to BOL on</td>
<td>Date image uploaded to BRAHMS online</td>
</tr>
<tr>
<td>Audit fields</td>
<td>Standard fields for who added/modified image record</td>
</tr>
</tbody>
</table>

**Image table fields.**

### Image file metadata

Images may have additional information embedded within the image files themselves – data stored in the image header. These data are exposed when you view images directly in the image library.
The image data is likely to include a lot of camera settings but also data such as image date/time, copyright, keywords and GPS data, depending on your camera facilities and settings.

Image location and file names

Images may be located in any location including in media libraries and cloud servers. Images may be referenced in any standard way include UNC paths. Rather than referring to physical file names, you can also refer to URLs. Using URLs implies your images are accessible online. The great advantage is that you will be able to view the images even if you do not have access to server path, for example, you may be using BRAHMS in a different location or country.

It is good planning to think through your image file naming strategy. Avoid using spaces in image file names as these are not easily managed if you are publishing images online. Image file names can use different languages and international character sets.

File names may use any language script.

The following are examples of valid file names and URL paths:

C:\MyImages\00015343.jpg
H:\SharedDrive\Images\00015343.png
\myfilestore\MuseumFiles\InsectImages\AASY00ww4046_12089.jpg
http://medialib.naturalis.nl/file/id/2436411/format/large

Using image URLs

You can store images as URL references, the advantage being that your images can be viewed from any location.
Images accessed from the Naturalis Museum media library. This BRAHMS database has over 5 million image records.

**Importing images and image links from Excel**

If you have many images to link to data in BRAHMS, it will more efficient to use the **Image Import Wizard** tool rather than manually linking the images via the Image Viewer. This tool has been designed to make it as simple as possible to link your images to any record in any BRAHMS table.

To use this option, all you need is an Excel (.xlsx) table that has a column with the image file names (or URLs) and one or more columns that will allow you to match the records to your data records in BRAHMS.

The **Image Import Wizard** tool has two key functions:

a) to import images and image meta data into BRAHMS, matching your excel file image field names with those used in BRAHMS.

b) To link the images to the appropriate records in the currently opened BRAHMS table, using your selected record matching criteria.

To open the image import wizard tool select **Import/Link images** on the **Data Tools** toolbar.
In the top image matching section of the form, you can match your Excel columns with the appropriate image data column(s) – these are the image data that will be imported and linked to matched data records.

As a minimum, the Image File name or a URL is required: If the filename also contains the full directory/folder path there is no requirement to match the folder separately as it will be automatically separated from the filename. All other image fields are optional.

If URL entries are added to the Image File field, these will be treated as URLs and processed accordingly.

Note. The image import can be processed even if the image files are not currently accessible.

In the lower section, you can match your Excel columns to BRAHMS data record columns – this controls which images will be linked to which records.

Ensure the columns selected match the correct records in your database. For example, if you are linking images to specimen records based on the barcode, ensure the Excel file has a column with the barcodes. In the example here, the match is made between the Excel field ‘Plant Name’ and the BRAHMS field # Full Name. Any field or series of fields can be selected.

Note. Make sure any columns you want to use in matching are visible in the grid before using this tool.

---

**Importing images from Excel - examples**

**Image import example 1**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Species name</td>
<td>C:BRAHMS Images\Sample Images\Pinus_kamtschatcica_01.jpg</td>
<td>BRAHMS Project demo only</td>
<td>Sample caption</td>
</tr>
<tr>
<td>2</td>
<td>Pinus kastchickica</td>
<td>C:BRAHMS Images\Sample Images\juniper_03.jpg</td>
<td>BRAHMS Project demo only</td>
<td>Sample caption</td>
</tr>
<tr>
<td>3</td>
<td>Juniperus wallachiana var. loderi</td>
<td>C:BRAHMS Images\Sample Images\juniper_wall_03.jpg</td>
<td>BRAHMS Project demo only</td>
<td>Sample caption</td>
</tr>
<tr>
<td>4</td>
<td>Pinus pumilio subs. hamlinii</td>
<td>C:BRAHMS Images\Sample Images\image_03.jpg</td>
<td>BRAHMS Project demo only</td>
<td>Sample caption</td>
</tr>
<tr>
<td>5</td>
<td>C:BRAHMS Images\Sample Images\Widdingtonia_cupressoides</td>
<td>C:BRAHMS Images\Sample Images\Widdingtonia_cupressoides_3.jpg</td>
<td>BRAHMS Project demo only</td>
<td>Sample caption</td>
</tr>
</tbody>
</table>

Snapshot of a sample Excel file with demo image details and also a field to use for record matching, in this example ‘Species name’. Note that the imagemfile field includes the full path name of the images. In other cases, file and directory names may be held in separate fields.
In the above example, the user has matched the image fields to be imported. Note that it is not necessary to add the Directory name - in this case, the image file includes the full path. The records are being matched using an excel field called Species name and this has been matched to the BRAHMS field #Full Name.

Image import example 2

The excel file here includes barcodes that can be used to match to records in the BRAHMS specimen table. The other fields such as family, genus, sp1, in this case, need not be used for matching as the barcode is sufficient. The image file and directory names here are held in separate fields.

The selected image and matching settings.

Note that record matching may involve using several fields – you can select any group of fields that you feel will match records correctly. You may have exported data from BRAHMS to Excel including the record GUID – and this on its own would be sufficient.
As the data are imported, the Status is updated. Status options are:

- **Unmatched**: the importer is unable to match the data to a record in the current BRAHMS table. For example, a barcode cannot be located.
- **Matched**: the importer is able to match the data to a record in the current BRAHMS table. However, it is unable to add an image as the image data are not correctly available in the Excel file. Note that the image file itself is not accessible, this will not stop the import.
- **2 Matched**: (2 or more) the importer has located more than one potential record match and the process cannot proceed.
- **Imported**: the image is successfully added to your image table and the image linked to a data record.
- **Exists**: the image data have already been added and will not be added again.

**Importing images from Excel to RDE files**

As discussed in the RDE sections, images can be transferred from Excel files to RDE. When transferring RDE files to BRAHMS, the RDE image data are added to the main database.

If your Excel file includes image references as physical file names (path + file name) or URLs, these can be imported to and viewed in the RDE file. If there is more than one image, the entries should be comma or semi-colon separated or on different lines.

By default, BRAHMS checks for the fields Imagelist or Images and auto-selects either if they are available. Otherwise, you can select the image field using the field selector provided.

In the above Excel table, the column Imagelist includes physical file and URL references.
Documents and Dynamic WebLinks

Documents

Multiple documents of any type can be linked to any record in BRAHMS. This could be a PDF material transfer agreement or collection permit linked to a specimen, accession or transaction; a protologue description linked to a species; a sound file linked to an animal entry; or perhaps a video or slideshow linked to a botanic garden greenhouse record.

Linking pdf, docx, wav, pptx and xlsx documents to a species record. Media and documents can be opened using the Open option or double-clicking on the linked entry.

Dynamic WebLinks

You can dynamically link your database to external websites as provided on the WebLinks toolbar. WebLink options will soon be configurable in BRAHMS, allowing you to add the websites that you find most useful. WebLinks are available from many of the BRAHMS tables, especially when there is a species name in the table. As an example:

- Select Taxa > Species to open the main species table.
- Select WebLinks > Google Images or WebLinks > POWO (Plants of the World Online)
In this example, the POWO website has been opened on Podocarpus taxifolius, a synonym of Prumnopitys montana. Moving data grid records auto-updates the open weblink page. The species form is opened on the synonyms tab and the various windows are docked.

An example with 2 weblink sites opened at the same time. Linked weblink windows can be dragged to different monitors.
Examples with the ant genus Acromyrmex, top Google Images, lower using AntWeb.
Biblio module and Literature

Introduction

You can store references of any category (books, journal articles, websites, etc.) and then link these to any record in your database. For example, you may want to link a book, a book chapter, a report or journal article to a species or to a selected text entry for a species.

As discussed below, reference entries can be stored as complete reference text strings with no attempt to divide the text into the component fields – or you can store the reference using the separate fields for author, title, journal, pages, year, etc.

Page numbers can also be added to the record that links a database record to the literature entry. Thus, you might enter the details for a book or manuscript once as a reference for many species. The record that links the species to the book will include the page numbers and other details about the nature of the literature link.

Adding and editing literature entries

Select Bibliography > Literature List to open the main table for literature. On the same Bibliography menu, you will find a table of literature categories and journal listings.

Viewing reference entries in the main literature table.

The Full Reference field can be used to quickly add a complete reference string – without needing to add data to the separate fields – although data added to separate fields provides greater control. The Full Reference field is auto-updated from the other fields if an entry is made in the TITLE field.

Linking literature entries to data

Literature links are created using the Literature option on the Data Tools toolbar.

This option allows you to select any item from your main literature list and link this to the current record. You can link multiple literature links to any record, optionally adding the relevant page/plate numbers, the link status (for example ‘Synonymy’) and comments.
An example showing the Literature link option opened. This option lists all existing links for the current record and allows you to add/remove links.

**Linking literature to taxa text entries**

Literature links to taxa text descriptions can be made directly in the Taxa > Taxa Descriptions table.

In Edit mode, use the form Edit option to edit the text and/or literature links.
The species form Text option – with the edit option in use. Here, you can add/edit the text entries as well as linking literature entries.
Designing reports

Best to use a large monitor and a mouse when working with report design.

Introduction

Rather than providing a fixed set of reports, BRAHMS provides tools that allow you to design and save your own report templates. These templates can then be used to produce almost any imaginable report output starting from basic lists and labels to more complex designs with indexes and calculated summaries.

BRAHMS is dynamically linked to a third party reporting tool called Stimulsoft. We chose this as it is rich on reporting features and many of these can be controlled from within BRAHMS. Those interested to explore to full extent of its capabilities are encouraged to refer to https://www.stimulsoft.com/en/documentation/online/user-manual/ or to download from: https://admin.stimulsoft.com/documentation/Stimulsoft_Reports_User_Manual.en.pdf.

While the design steps in the examples that follow may seem daunting, once mastered, you will be able to design almost any report you need. It’s satisfying to conquer reporting and it makes your database efforts all the more worthwhile. We encourage you to test and explore the reporting features which go well beyond those introduced in this section.

Report templates

A report template is a report design file. Each template is a single file with a .mrt extension. Templates can be given any sensible name (‘My RDE label’, ‘Genus Index’, etc.) and stored in any folder. They can be shared with other users.

Report templates are associated with a category of data and must be used with that category of data. If you design a report template for use in RDE specimen tables, it would not be possible to use this template in another type of RDE file or in the main database. Once designed, a given template can be used as often as is needed against any data in the appropriate table. For example, a report template designed for a specimen RDE could be used for any specimen RDE file you create. After creation, templates can be edited as needed.

There is no special table in BRAHMS to register report templates (as there is in v7). When you open the reporter, you can choose the template to use from the File options – recently used or browse to locate.

The reporter is accessed from any table using the Reports option on the Data Tools toolbar. NB the Print Preview option is an entirely separate and more limited tool for creating quick tabular summaries based on your current field selection.
The **Icons** on the left side are used to create reporting 'bands' and add other features such as images to your report. The menu at the top includes the main design, layout and preview options. The lower **Properties** tab displays all the available properties for the currently selected item (here the page properties). The **Dictionary** tab (not selected here) displays the available data table(s) and fields.

Using the **Setup Toolbox**, you can add many more tools to the left margin and further explore the reporter capabilities.
Preparing a basic taxa list

This preliminary example creates a tabular report with the family, genus and species names, but only printing the family and genus names when they change. Most of the steps in this example are discussed in more detail in the next report example. This first example uses minimal formatting.

Tagging the records for your report

The reporter is opened from any data grid using the Reports option on the Data Tools toolbar. When you open the reporter, BRAHMS only passes data from tagged records - thus, be sure to tag records to process before you select Reports. If you want to process all records in the current file, you must tag all the records.

- On the main menu, select Taxa > Species then use Tag > Clear Current Grid Tags.
- If you want to restrict this report to show only names where Taxon Status is Accepted, apply the appropriate filter. Then select Tag > Tag all (you can use any character).
- Select Reports to open the report designer.

The report designer, with the Dictionary tab selected, open and ready to use.

It’s always a good idea to save your report design from the outset, giving it a sensible name. Then you can just use the top left Save option as you proceed.

Adding the data to your report

- Select the Dictionary option and drag the Species table icon onto the report surface. This opens a field selection form.
• Select the fields FamilyName, GenusName and CalcFullName and sort these as shown above.

This will add a DataSpecies report band as shown above. You can already Preview this list. After previewing, return to the editing mode using the Page tab. Previews may take some time to generate.

Next, adjust the field widths.

• Click on the FamilyName entry within the band and reduce the width by dragging the right edge or using the properties tab Width option. Resize the other fields allowing less space for the family/genus names but more space for the full species name. The widths can be refined later. You can also set field widths using the Position properties for the fields.

The next stage is to sort the data appropriately. Note that sort commands are stored within the report itself.

• To sort the data, double-click on the top of the newly added data band and choose the Sort option.
• Use Add Sort to add sort entries for the FamilyName and the CalcFullName.

As the CalcFullName includes the genus, it is not necessary to add genus to the sort list.

Previewing the report will now display these data correctly sorted.

In order to print the Family and Genus names only when they change:

• Click on the \{Species.FamilyName\} field on the report and then select Properties.
• Under the Text Additional options, set ProcessingDuplicates to 'Merge'.
• Repeat this for the GenusName.

If you Preview now, you will see that the edited fields appear once per name.

The table will look better if all the fields are aligned at the top of the cells. To do this:

• Select the fields one by one or shift click to select all three. Then use the Align Top option on the Home toolbar.
Using the Align Top toolbar option.

- **Save** and **Preview** the report.

Finally, for this basic list, set the font of the family and genus names to **Bold** by selecting these two fields and using the **B** font control on the main toolbar. Increase the font size slightly for the family and genus.

A sample of the final report. You could easily save this to a Word document using the Preview Save option.

Preparing a species list with page set up and conditional formatting

This example is based on the sample conifer database as it has Red List data (IUCN codes). But you may use another database as appropriate. Or replace the IUCN field with another as suits.

Tagging records for your report

The reporter is opened from any data grid using the **Reports** option on the **Data Tools** toolbar.

Be sure to tag records to report on before you select **Reports**. If you want to report on all records in the current file, you must tag all the records.

- On the main menu, select **Taxa > Species** then use **Tag > Clear Current Grid Tags**.
- Apply a filter to show only names where Taxon Status is **Accepted**. The easiest way is to click on the word Accepted in the Tax Status field and then on **Selection** on the **Data Tools** toolbar. You can choose a different filter if appropriate.
- Now select **Tag > Tag all** (you can use any character).
- Finally for this first stage, select **Reports** to open the report.

The report designer is now open and ready to use.
Report bands

Report bands, central to report production, are like containers, each with a different function. Examples bands are Page Header and Footer bands (similar to Word Document headers and footers); The Title band which is printed once at the start of a report; Header and Footer bands which are associated with your Data band (an example use is to print table report column headers); Group Headers and Footers (an example use is to print a Family name at the start of a list of taxa in that family); and the Data band which will output data for each row in your BRAHMS data grid. There are other bands but these are the key ones. As well as adding content to bands, they are highly configurable with formatting features.

Adding a title band

As a first step with the report design, add a title band with some text. All the band options are listed down the left side of the blank report screen. The title band icon is show below.

If you hover over this icon, the tooltip text explains its function.

- Click once on the icon and then click on the report surface — or drag the icon onto the surface.

Either way, you should see the Title band added to your report, and extended to the full page width. If you wanted to delete the band, selected it and press the Delete key. By default, the band will fix itself to the top of the report. You can increase the band height by dragging the lower edge of the band down or by editing its properties.

You can refer to and edit the properties of this band by clicking on it then choosing the Properties option on the lower right side of the designer. A Right-Click on the band provides further options including access to its Properties. For example, the properties can be used to format the band background with a gradient colour fill.

To add text to this band, you must add a text box component using the Text icon.

- Again, click or drag this icon and create a text area in the title band. You can create the text area anywhere on the report surface then later, drag it to the Title band.

When you add the text box, this auto-open the text expression editing tool. You can type the required text into the Expression area and save using OK.

Click or drag the Text icon to create text box inside the Title band and add a report title.

Clearly, there are a few tricks to learn here. Once added, you can re-open the text editor by Double-clicking the text box.

Formatting options for the text box itself, and the text it includes, are found on the Home menu, the Layout menu and/or in the Properties options for the text box. For example, to centre the text box in the title band,
use Layout > Align > Centre horizontally. But to centre the text within the text box, use the Home > Alignment options.

**Add an image to the Title Band**

To add an image or logo to the Title Band, select the Image toolbar option on the left list of icons and click in the title band. The image can be positioned and re-sized. In the image properties options listed on the right pane, select the AspectRatio to ensure the image keeps the correct shape if re-sized. Also you will need to select Stretch to ensure the image is re-scaled to fit the size you choose for the report.

![Image added to Title Band]

Title moved to side with the font edited and an image added to the Title Band. Adjust the properties as suggested above.

**Saving the report**

At this stage, it will be best to save your report design work. Use File > Save, choose any folder and give your report template a name. You could at this close and then re-open the report to continue editing. To open a saved report, choose File and you will see your recent reports or be able to browse to locate them. Unlike with v7, there is no central reports manager file. Report files can be exchanged with other users.

**Adding page numbering**

In this example, you can add page numbering to a page footer - similar to a Word Document footer. You could equally add to a page header.

Click on the left margin Page Footer icon then click on the report surface (or drag the icon as above). The footer band will by default auto-locate to the bottom of the design surface page. NB. you may need to scroll down to see this.

![Page Footer Band]

The page footer band is different to a data summary footer. Scroll down to see the added band.

As with the Title band, the properties of the Page Footer band are highly configurable.

To add the page number using the format ‘page of total pages’:

- Select the Dictionary option on the left panel and choose System Variables. Here locate the entry PageNofM.
- Drag this variable onto your Page Footer band. It will be added into a text box feature.
- Use the various formatting tools to align the text and set the font features. Ensure the text box width is enough to show the text.

If you Double-click the text box to open the text editor – and then choose Expression, you will see that the variable PageNofM is enclosed in braces as in {PageNofM}.
In this example Page Footer, the line tool has been used to add a horizontal line below a further text box and the page numbering. The items are positioned appropriately and the colour and font adjusted. Some experimentation is needed.

Save your report design before proceeding.

**Adding the data band**

The data band is the most important band as this is the link between your data and the report. This band can be added in two ways, either using the data band icon on the left side or by using another approach from the Data Dictionary. Here, the latter option is used.

- Select the **Dictionary** tab. Here you will see the current BRAHMS data table listed.
- Drag the **Species table** icon onto the report surface (not the yellow Species container icon above it).
- As you drop this onto the report surface, a dialogue opens offering the chance to select which fields to include. At this stage, only select the 3 fields: CalcFullName, IUCN and ProtologueCitation. There are other ways to add data fields to the data band but this is a convenient method for now.
- Adjust the field order using the arrows provided to move the ProtologueCitation above IUCN.

When adding the Data Band, you can also select the fields to include. The selected fields can be adjusted later if necessary.

The properties of the Data Band can be adjusted as with the others. To do this, ensure you click on the Data Band itself rather than either of the text boxes within it. Then choose the Properties tab. There are numerous properties for data bands but at this stage, it’s not necessary to alter these unless you wish to experiment. If you click on either of the text boxes within the Data Band, you can then set the properties of each text box, for example the font.

By default, each field is given equal space. This can be adjusted to give the species name a lot more space than the 2 letter IUCN code. You can drag the field edges to re-size or use the properties options to set the widths.

Here, the field widths have been adjusted. Also, the text for IUCN has been **adjusted right** using the align tool.
By double-clicking on the IUCN field, it becomes possible to add literal text to the expression. In this example, the expression [Species.Iucn] has been enclosed in square brackets [{Species__Tagged_.Iucn}] which will print e.g. [VU]. NB Be sure to add any text outside the { }.

However, the square brackets need to be supressed if there is no IUCN Red List value. Otherwise you will end up with the ugly [] appearing in your report. This can be achieved by adding the following syntax to the expression (You can copy the full expression and paste this into your report):

$$\{IIF(Species.Iucn != "", ",", "]\}$$

The handy IIF function is used to control what is printed. Looking more closely at $$\{IIF(Species.Iucn != "", ",", "]\}$$, this translates to … if the Species.Iucn field is not blank (!’!=’ means not = to), then print ‘[’ otherwise print ‘”’. Thus here, the function is used twice for the [ and the ] brackets.

The height of the data band controls line spacing in your report. The width of the individual text boxes can be adjusted.

Save your report design before proceeding.

Adding a Group Header

Group header bands are used to group data by one of more fields. In this report, it will be useful to group the data by family name. To add a data grouping header:

- Click once on the Group Header icon and then click on the report surface – or drag the icon onto the surface.
- If the newly added band is below the Data Band, drag the band up and release it above the Data Band.

You now need to assign a what is termed a ‘condition’ (in this case a data field) to the Group Header band and also, add the data field to include in the report.

- Firstly, to add the group ‘condition’, double-click on the band to open the data source (in the case the species table) and choose the field FamilyName. You will then see this added as a ‘condition’ in the band header. When you add a text condition, the default sort for he grouping is AZ Ascending.
- Secondly, add a text box to the group header band. Double-click this, choose a Data Column and add the FamilyName.

The Group Header Band showing the Condition Species.FamilyName and with the FamilyName added to a text box as a printable field. The family name font and position has been adjusted.

Progress this far
Sorting the data

Separate to the group sorting, the data in the data band will need a sort order added. This can be one or more data fields added to the data band but in this case, the report only has to be sorted by the CalcFullName.

- Double-click on the top of the Data Band (not on one of the text fields it contains).
- Choose the Sort option and then choose the field CalcFullName.

The sort option being used with the Data Band.

- Use the Preview option to check your report – and it’s a good idea to Save the report design again.

Adding a condition to the data band

For this report, you could optionally colour the reported records depending on the Red List values, for example, printing the CR, VU and EN categories taxa in different colours. To do this, it is necessary to add one or more Data Band ‘conditions’. Conditions can be used in a wide variety of ways –this example sets a row highlighting condition.

- Click on the Data Band header to select this. Take care to select the band rather than one of the fields it contains. Then select the Conditions option on the toolbar.
- Select Add a condition choosing the Highlight Condition option.
- Set the Column value to Species_Tagged_Iucn

Three highlight conditions added to the field Species_Tagged_Iucn

Adding a border box around the data band

If you now select the Rectangle option on the left side toolbar, you can carefully position and size a rectangle with the required line style and colour to fit around the data band items.

Detail showing the red dotted rectangle. This was set to red for this screen but edited back to a light grey colour.
Close up of report detail. A rectangle has been positioned in the data band surrounding the three fields – and the line style properties adjusted.

Print report or save to a document

In Preview mode, you can choose the required output, either printing directly or saving the report to one of several file formats including Word and Excel. One advantage of saving to a document is that the report can be further edited prior to final printing.

The final report layout

Designing a specimen label

Following on from the previous section on creating a list report, creating a label report template introduces a few new aspects to report design. This example assumes you have mastered the basic of opening the reporter and creating report bands. Unlike the list report above, this report template will only have a Data Band. The Title, Page Header and Group bands are not needed. Designing labels introduces the use of page columns, the
ability to combine fields in expressions, the use of HTML tags, conditional clauses and the use of calculated fields.

The example here reviews label production in the main specimen table. You can design a label in an RDE file using the same steps but the field names will change to an RDE prefix. You cannot design a single label template for both RDE and the main specimen tables.

**Tagging the records for your labels**

To create labels for preserved specimens, you have to open the main specimen table and tag the appropriate records. As introduced in the previous section, the reporter is opened using the Reports option on the Data Tools toolbar.

- On the main menu, select Collections and select the category Preserved specimens. Now open the main Specimens table. Use Tag > Clear Current Grid Tags and then tag the records to produce labels for.

**Create the report template page layout**

- Select Reports to open the report.

Assuming you wish to print labels in two columns:

- Select Page > Columns and set the value to 2. This would also be the time to set the paper size if necessary.
- In the lower left pane, select the Dictionary tab and drag the Specimen table icon (not the yellow drum) to your report design surface. By default, this will position itself at the top of the left column.
- When you drag the specimen data source, you will be offered the chance to select fields. For this report, do not select any fields at this stage.
- Drag the Data Band down to increase its height. The precise height can be adjusted later to obtain e.g. 6 labels per page. To help visualize the layout, add a rectangle to the report using the rectangle icon on the left side. Size this to almost fill the data band area.

Here, the report page (left) has 2 columns, a Data Band has been added for the Specimen data source. A rectangle has been added to provide a visual reference. This rectangle may be removed later. The Preview (right) at this stage displays the rectangle layout.

**Adding text for the top of the label**

Assuming you want to include some text to the top of the label, perhaps “Flora of” or your herbarium name, follow these steps:

- Click or drag the Text icon onto the Data Band. You can now edit the contents of the text box and set properties such as font, text size, alignment and colour.
• To edit the content of the text box, double-click the Text Box or click on the Text Box then select the Text button at the top of the Properties options.

• Use the Home menu options to set font, size and other basic features.

The text is centrally aligned within the text box and the text box itself is centred horizontally using the Layout menu option.

Adding data fields

The label design starts by looking at taxa names which present the most complex part of the label design.

The easiest way to add a data field is to select the Dictionary tab in the lower left pane, expand the Specimen options, and then to drag the required field to the design area. This process adds the data field within a text box. The alternative is to add a text box and then insert the data field. This is possible, but there are more steps to take.

• Drag the field FamilyName from the dictionary to the label surface. Adjust the position of the text box and set the various properties as required. You will want to set the font to about 10 point. Make sure the text is adjusted left.

The start of the label template with the family name added. Note that the final positioning can be done towards the end of the design process.

Combining field names in a text box

Some elements printed on labels require that data from more than one field is combined into a single text box expression. For example genus + species + author. Multiple fields can be added to the same text box to create:

{Specimen.GenusName}{Specimen.SpeciesName}{Specimen.SpeciesAuthor}

• Drag the first field name (GenusName) on to the report design. This will create the initial text box. Then drag the fields SpeciesName and SpeciesAuthor to the same text box. The reporter will prompt how to append these fields with a series of positioning icons – choose the one with the small red hatched box to the right of the black hatched box – this adds the field to the last added field.

• Once these 3 fields have been added, double click the text box and then choose the Expression options.

The reporter will auto-trim these fields, removing trailing spaces between the fields. However, you must add a single space as in: {Specimen.GenusName} {Specimen.SpeciesName} {Specimen.SpeciesAuthor}. Although you can add this now to learn and test, this string will be replaced with a more complex one given below.
Using HTML tags

In order to print the species name with possible infra-specific names together with authors, part in italic font, part not, it’s possible to add some simple HTML mark-up tags. The ability to add these tags opens up options for setting multiple font settings within a single expression. The available tags are listed below the dictionary entries. HTML tags can be manually added to your expression.

The tags are always enclosed in angle brackets <> and they are placed outside the {} braces. There must always be an opening and closing tag. Thus, using the italics tags <i> and </i>, you can add:

\[\langle i \rangle \{\text{Specimen.GenusName}\} \{\text{Specimen.SpeciesName}\}\langle /i \rangle \{\text{Specimen.SpeciesAuthor}\}\]

This will print the genus and species names in italic font but not the author name.

If you are using HTML tags, you must ensure the text box property AllowHtmlTags is selected.

Using condition clauses to print the full taxa name

When printing species names with infra-specific elements and/or cultivar names, it is necessary to add some conditional clauses. For example, if there is a subspecies name, you will want to print the text ‘subsp.’ or ‘ssp.’ before the name - but not if the name is blank. For cultivars, you will want to add quotation marks.

The easiest way to do this is to use the IIF() function. This function evaluates a Condition, and if the Condition returns true, the expression will return Value1. If it returns false, it will return Value2. The syntax != in programming means ‘not equal to’. Note also that all programmatic components are enclosed in { }.

IIF(condition, return value if true, return value if false)

An example: \{IIF(\text{Specimen.Subspecies} \neq \text{""}, \text{"ssp."}, \text{""})\}\}

Here, if the field Specimen.Subspecies is not equal to blank, it returns “ssp.”, otherwise it returns an empty string. Using this, you can now develop the complete expression for all possible species epithets as follows:

\[\langle i \rangle \{\text{Specimen.GenusName}\} \{\text{Specimen.SpeciesName}\}\langle /i \rangle \{\text{Specimen.SpeciesAuthor}\}\]
\[\langle i \rangle \{\text{IIF(\text{Specimen.Subspecies} \neq \text{""} \\text{or} \text{"ssp."} \\text{or} \text{"var."}, \text{"subsp."}, \text{""})}\}\}
\[\langle i \rangle \{\text{Specimen.Subspecies}\}\langle /i \rangle \{\text{Specimen.SubspeciesAuthor}\}\]
\[\langle i \rangle \{\text{IIF(\text{Specimen.Variety} \neq \text{""} \\text{or} \text{"var."} \\text{or} \text{"cultivar"}, \text{"var."}, \text{""})}\}\}
\[\langle i \rangle \{\text{Specimen.Variety}\}\langle /i \rangle \{\text{Specimen.VarietyAuthor}\}\]
\[\text{IIF(\text{Specimen.Forma} \neq \text{""} \\text{or} \text{"f."} \\text{or} \text{"form."}, \text{"f."}, \text{""})}\}\]
\[\langle i \rangle \{\text{Specimen.Forma}\}\langle /i \rangle \{\text{Specimen.FormaAuthor}\}\]
\[\{\text{IIF(\text{Specimen.Cultivar} \neq \text{""} \\text{or} \text{"cultivar"} \\text{or} \text{"var."} \\text{or} \text{"f."}, \text{""}, \text{""})}\}\}\]
\[\{\text{Specimen.Cultivar}\}\{\text{IIF(\text{Specimen.Cultivar} \neq \text{""} \\text{or} \text{"cultivar"} \\text{or} \text{"var."} \\text{or} \text{"f."}, \text{""}, \text{""})}\}\}\]
\[\{\text{Specimen.CultivarAuthor}\}\]

Using this expression avoids printing ssp. or var. or f. when there are no names of these ranks. You can replace “ssp.” with “subsp.” or as required. Also, the function encloses cultivar names in single quote marks. Cultivar names are not printed in italic.

It looks complex – but in any case, you can simply copy this entire expression to the species name text box in your report – replacing the \{Specimen.GenusName\} \{Specimen.SpeciesName\} \{Specimen.SpeciesAuthor\} that you added above.

The text box area can be sized appropriately later – it does not have to be large enough to see the entire expression in design – only on display. If your HTML tags are not correct, make sure the text box property AllowHtmlTags is selected.
On the left, a fictitious name entry with all epithets and all authors. The name shows the correct format and fonts.

**Adding geographic data and other notes fields**

Geographic data can be added field by field (Country, MajorAdminName, MinorAdminName etc.) allowing you to format the data exactly as you wish. Alternatively, take advantage of the calculated field CalcFullGazetteerText. This calc field includes all fields from country to place name with locality notes, pre-formatted. It does not include the map reference.

- Using the same methods as above, drag CalcFullGazetteerText from the specimen dictionary list to the design surface.
- Size the text box to be large enough (height) to include the longest text you will encounter.
- Important - select the property WordWrap (under Text Options).

NB. To print fixed size labels and thus, a constant number per page, easy to guillotine, the text box should be sized deep enough to fit the longest text you expect for the field. The alternative is to size the text box for e.g. one line – and set the property CanGrow to true. However, if you opt for CanGrow, the labels will most likely not be equal size in the columns. WordWrap is import though, otherwise, text over one line will not be visible.

You can combine CalcFullGazetteerText and CalcLatLongText in a single text box adding the HTML tag <br> between these to create a new line.

```
{Specimen.CalcFullGazetteerText}<br>{Specimen.CalcLatLongText}
```

Some example output including the taxa and geodata.

Further items could be added to the same text box as used for the geographic data including text notes for habitat and the specimen description.

```
{Specimen.CalcFullGazetteerText}<br>{Specimen.CalcLatLongText}<br>{Specimen.HabitatText} {Specimen.PlantDescription}
```

The way you decide to arrange this will depend on personal preference. You may wish to include line breaks with <br> or just spaces between items. Remember, if you are using HTML tags, you must ensure AllowHtmlTags is selected in the Properties. Some trial and error testing will be needed to get the correct text box sizes and fonts.

**Adding collector name(s), field number and date**

In this example, the collectors and field number are added to a shared text box. Drag the field PrincipalCollector and FieldNumber from the dictionary to the label surface to create a single text box. To do this:

- Open the data dictionary on the left side and expand the Specimen Data Source. Drag the PrincipalCollector field to the design surface and roughly position and resize the text box.
• Now drag the FieldNumber on top of this text box. A red box appears and a small form opens to request if and how you wish the fields to be joined in the text box. Choose the option with the small red shape to the right of the grey shape.

![Image showing how to add FieldNumber and select style]

By editing the properties of the text box expression you can now add a space between these fields and optionally add a text string such as ‘No.’.

• Finally, drag the field CalcLongCollectionDate to a new text box. Position this to the right. You may want to right align the text.

The label as above designed.

![Image showing labeled text boxes]

The same exported to a Word document.

Preparing a transaction list

This example shows in summary how to produce a transaction packing list for loans, exchanges and similar. Transaction reports use the same techniques are the previous examples. One difference is that they refer to two separate data sources – the transaction record itself and the linked specimens. This requires the addition of two data bands.
The Title band includes a logo, some constant text entries plus a few fields taken from the transaction record including the address summary (sent to/received from), the transaction number, a calculated summary of the transaction and the ‘attention of’ field.

A data header and data band have been added to list data from the LinkedSpecimens data source. Fields can be chosen as required.

A partial sample preview of a transaction.
A closer look at taxa and related data

Video: https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#addingspeciestext

Introduction

BRAHMS has separate tables for Higher Classification, Families, Genera and Species, the latter including infra-specific names and cultivars. All ICN and ICNCP ranks are covered. There are also separate tables to store author names, common names, plant uses and text descriptions.

The main taxa tables

Higher Classification

The higher classification table, by default, stores taxa names from Kingdom through to Order. Further taxonomic levels can be added as custom fields.

You can define further custom higher classification taxonomic levels as needed for particular taxa groups.

Families and genera

The family and genus tables, in addition to storing the names of families and genera themselves can be extended with custom fields as needed by your project. Each name can be assigned an authority and be linked to publication details. Further nomenclatural fields are available such as taxon status, validity, legitimacy and nomenclatural notes. There are further fields for common names, museum location code, specialist name(s) and more. These tables also have various calculated fields to display totals for linked collections, images, seed accessions, living plants, etc.
Managing columns in the genus table. If entirely new fields are required, these can be added as custom fields. Data fields are also inherited and displayed from the higher classification and family tables.

Species and lower ranks

Species and infraspecific names are stored in the species table. A wide range of default fields are available from ranks between genus and species such as genus section and series through to all the infra-specific, grex, trade and cultivar names. As with the other tables you can extend the table by adding further taxon levels as custom fields.

Adding a new species

You can add new species to your database either directly or via Rapid Data Entry (RDE) files. RDE is normally used when you have many new names to add. In this example, add the new names directly into your database using the data grid and/or the species form.

If the new names are in families or genera not yet stored in BRAHMS, you need to add these first. For example, to add a new genus:

- Select Taxa > Genera and then use the Add option on the Data Tools toolbar to append a blank record.
- Select Edit on the Data Tools toolbar to switch to editing mode – then type in the new genus name.
- To select the family name, use the lookup function (F9 key) in the Family field.
• Now select **Taxa > Species** and then use the **Add** option on the **Data Tools** toolbar to append a blank record. Enable editing mode by selecting **Edit** on the **Data Tools** toolbar.
• New data can either be added directly to the data grid or using the species form opened using the **Form** option on the **Data Tools** toolbar.
• Using either the data grid or the form, add a few new species records, adding as much detail as you want.

**Synonyms**

You can link one or more of your new names as synonyms of another name you have added.

*If the name is a synonym of another name, you can set that on the **Name** tab of the species form*

**Common names**

Common names can be linked to family records and to the main taxa table. A taxon entry may have numerous common names across its range and each these can be recorded with notes about name origin, meaning, language and folklore. Common names can be listed directly by opening the common names table — or by using forms on the main species/entity tables. Names can be added directly to the table and/or from the forms.
The common names table has the following structure:

<table>
<thead>
<tr>
<th>Field name</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag</td>
<td>Standard field for tagging records</td>
</tr>
<tr>
<td>Del</td>
<td>Standard field for deletion</td>
</tr>
<tr>
<td>CollectionEventId</td>
<td>Link to a collection event (and thus location/species)</td>
</tr>
<tr>
<td>SpeciesId</td>
<td>Link to a taxon name</td>
</tr>
<tr>
<td>EntityId</td>
<td>Link to an entity</td>
</tr>
<tr>
<td>Common name group</td>
<td>Names can be organised into groups</td>
</tr>
<tr>
<td>Common name</td>
<td>The common name</td>
</tr>
<tr>
<td>Homonym</td>
<td>Differentiate between identical names</td>
</tr>
<tr>
<td>Name rank</td>
<td>A numeric code to rank names by preference</td>
</tr>
<tr>
<td>Suppress</td>
<td>A flag to suppress (offensive) names when publishing</td>
</tr>
<tr>
<td>Language</td>
<td>The language of the common name</td>
</tr>
<tr>
<td>Dialect</td>
<td>The language dialect</td>
</tr>
<tr>
<td>Source</td>
<td>The source of the name</td>
</tr>
<tr>
<td>Etymology</td>
<td>The meaning of the name</td>
</tr>
<tr>
<td>Interview</td>
<td>Notes on interview (e.g. with local people)</td>
</tr>
<tr>
<td>Folklore</td>
<td>Name folklore</td>
</tr>
<tr>
<td>Comments</td>
<td>Other comments</td>
</tr>
<tr>
<td>GeoNote</td>
<td>Geographic notes (especially where no linked collection event)</td>
</tr>
<tr>
<td>Audit fields</td>
<td>Standard audit field (who/when added/edited)</td>
</tr>
</tbody>
</table>

**Text descriptions**

Free text descriptions can be stored and linked to different taxa levels (currently family, genus, species and infra-taxa). Text can be added under any category such as Description, Distribution, Ecology, Uses, Conservation, Taxonomic notes, etc. You may want to store several descriptions for a species – from different sources. Each entry can be linked to a reference source.

With the species form open, select the **Texts** tab. You can add new entries as well as edit or delete existing entries.

To add a new entry, use the button adjacent to the species name.

All text entries are stored in a special table which you can also edit directly using **Taxa > Taxa descriptions**.
Editing a species author name

Author name abbreviations are stored individually in the main People table. However, the author name compilations that link to taxonomic names come from the ‘Assembled name strings’ table. Both tables can be opened under the Management menu. Authors of taxa may consist of formatted combinations of names as in ‘(Poepp. ex Endl.) Tiegh.’.

You can edit names from the grid or from the species form. Author names are held in a separate table and thus cannot be edited directly in the grid or form. You have to use a lookup function.

- Select Taxa > Species to open the species table and locate a species to edit. Ensure you are in Edit mode.
  
  Go to the species author field and in Edit mode, press the F9 key to activate a lookup.

When you open the Author Selector form, it will select the current author name from a list of compiled author strings. To search for a new name or name combination, enter some text in the Data Grid filter row. To construct a new author string, choose names from the list of people table abbreviations provided and then use the formatting tools to construct the required string. Here Franch. Has been set as the Basionym author creating the string (Franch.) Rehd. & E.H. Wilson.

You can prefix a name with Sensu and/or append a suffix to an author string, for example ‘Sensu lato’ or ‘, 1987’.

To reverse the change, select Edit History and when you are in the Species Author field, you can use the Undo option as shown above.

Is Author field

The Is Author Field in the Assembled name strings should be ticked (true) for any entry that represents an author. Only records that have Is Author = true are visible when selecting author strings using lookups.
Further taxa options

Name editor

The name editor allows you to update all or tagged dependent names. For example, you may have a species named maxima in the genus Cattleya which is incorrectly spelt or has to be changed for another reason. The species may have dependent names (subspecies, varieties, forms, cultivars or ranks). This tool allows you to edit the name of the species (or any other selected rank below genus) for all or tagged records. You would use the tagged option if you were separating names into different groups.

A hypothetical example where the species named maxima in a particular genus could be quickly edited for all dependent names, in this case, a series of cultivars.

Orthographic checks

This tool provides a way to quickly check names that have potential spelling errors. It does this by sorting names A-Z and then checking for names with the number of character differences you select in the Match Tolerance setting. Records which vary with 1 character are tagged 1. Those with 2 character differences are tagged 2, etc. After processing, a filter is set to show the tagged records.

An example check showing records with 1 and 2 character differences. It is then the decision of the person checking the data if the differences are valid or mistakes.
Listing all related taxa names using from the Infra+ tab

From the main species table, use the Infra+ tab on the species form to list all names with the same species epithet within the current genus. Here, you can also access descriptive text linked to any of the taxa in the list.

- Select Taxa > Species and then open the species form – then select the Infra+ tab.

Note that you can restrict the names listed to selected ranks. The fields displayed in the grid can be adjusted using a right-click on the grid header. The Taxon Descriptions option opens any text descriptions as available.

Extend tags to related infra taxa

The option Extend tags to related infra taxa will tag all records of names that belong to the same species as any currently tagged records.

In this example, all records of Abies Alba have been tagged based on the tagged record in the left screen.

Tag synonyms of tagged records

The taxa menu option Tag synonyms of tagged records tags synonyms of any tagged records.

In this example, synonyms of Dacrycarpus kinabulensis have been tagged.
Collection events

Introduction

Collection events refer to the data describing an item found in a specific place usually by a known person on a known date. A collection event many result in physical specimens being collected and deposited in a museum. However, an event may also refer to an observation, a literature citation or any other source of data. Collection events themselves are not physical specimens. To access collection events, select Collections > Collection Events on the main menu.

Some records from a typical events table. Events keep track of the collector(s), field number, collection date, locality as best known, descriptive text about the location, habitat and the item itself and the identification the item is known by (the 'selected determination'). You will not find an accession number or barcode as these belong to physical specimens. Many other event fields are not visible in this screen.

The collection events Form provides access and editing tools for linked specimens and their determinations. With this event for a plant collection, there are 6 specimens distributed to various herbaria. The specimens are types with the holotype at Leiden. Each specimen may have 0 to many determinations.

Collection event categories

The Category option on the Collection toolbar is used to further define the toolbar options for preserved specimens, living collections, seed banks and others. In all cases, data for the events themselves are stored in the same table.
Selecting a specific collection category alters the toolbar menu options.

Links to living collections and seed accessions

Collection events are also used to record the wild origin for living plants and the collection passport data for seed accessions. For example, in a botanic garden, if the wild origin of a plant is known, the living accession entry will be cross referenced to a collection event.

Geographic data, maps and elevation

The collection event location will be defined as accurately as possible. Details gathered from older specimens may be rather vague, to country level while these days, collections are often geo-referenced with pinpoint accuracy using a GPS map reading.

Locality names and the gazetteer table

Collection events link to an entry in the main gazetteer or places table which is opened and edited using Geo > Gazetteer. The gazetteer table stores a link to the country table and then the names of major and minor administrative areas and a locality name if known. Map and elevation data can be added. The gazetteer record may only have a country name – the other data may be unknown and left empty.

The collection event record has a link to the gazetteer locality. In the collection event table itself, you can store locality notes and map/elevation data. Map and elevation data stored here always take priority over these data in the linked gazetteer record.

Map data

The use the map editor is discussed in the relevant map section.

An example showing units in DMS (form banner) but stored in Decimal degree format.

Elevation

Elevation data are stored in m and if added to the grid, should be added in m. units. NB a new editor is being added to allow m or ft. On the Map point editor, elevation can be added in m or ft and if using ft, the data are auto-converted to m.
An example where the altitude is entered in ft but stored in m.

**Selected determination**

Collection event records include a species identification – and this name is known as the *selected determination*. An event may have one or more specimen vouchers – and each of these in turn may have one to many determinations. The name you choose to use for the event can be selected (see below under Determinations).
Museum and herbarium specimens

Preserved specimens

Specimen records

If a collection event leads to vouchers being taken, these specimens will eventually be deposited in a museum/herbarium collection. They may be formally mounted and incorporated to the collection. Examples are birds, insects, fungi, ferns, higher plants – or indeed any form of preserved natural history collection.

Each specimen is linked to one collection event. Many of the fields seen in the specimen table data grid are inherited and displayed from the collection events table. However, others are specific to the specimen including the category of specimen, the institute code where it is deposited, accession number, barcode and various other fields including details for type material.

The options for specimens are available when you select the category ‘Preserved Specimen’ on the Collections menu.

Adding/editing specimens

Specimens can be added to the specimen table directly using the standard Add option on Data Tools.
Alternatively, you can add a new specimen when using the collection events form.

Duplicates

Sometimes, material is duplicated to more than one institution, especially the case with plant material. In this case, there will be two or more specimen records linked to the same collection event but with different specimen level details (where deposited, barcode, etc.). There is no limit to the number of duplicates you may store for a single collection.

A collection with 4 specimens deposited at different institutions. The related event record is stored once. Only one of the specimens has a barcode.

Specimen and type categories

These lists are held in separate tables.
Museum boxes and folders

Some museums (including herbaria) organize material in boxes which may have barcodes and location details.

Example list of barcoded boxes with a filter set to show contents with Lichens. Screen taken from Naturalis herbarium database.

In herbaria, specimens are organised into folders – and these folders themselves may be barcoded and registered in your database. The folders may be in a known box. Individual specimens can be associated with a folder.
Determinations

Introduction

The identification of a specimen may change. An expert in the taxa group may provide a new name, perhaps on a museum visit or by returning a loan. When a new determination is provided, a determination record is added to the specimen. This is better than editing the existing determination record as it ensures that previous dets are maintained.

A collection with several specimens may accumulate different determinations linked to each specimen. A decision must be taken as to which name to select as the correct one. This is referred to as the selected det and the name is stamped into the collection event.

Editing specimen determinations

The collection event form includes options to add, delete and edit determination records.

After adding a new determination record, you have the option to set this determination as the ‘current determination’ of the specimen. Also, using the option Set as Selected Collection Event Det, you can choose the determination as the name to use for the collection event itself.

To access the determinations table directly from the main collection menu, ensure you have the category ‘Preserved Specimen’ selected then select the Determinations option.
BRAHMS for Botanic Gardens

Introduction

The living collections module within BRAHMS manages data and images for botanic gardens, arboreta and other horticultural projects. The module, which already takes advantage of all standard features to edit, query, report, map, export and publish online, adds comprehensive additional features for garden accessions and plants and their management.

As these data are fully integrated within BRAHMS, it becomes possible to develop a comprehensive system for both management and research.

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxa</td>
<td>Develop an infrastructure of taxa from higher classification down to infra-specific levels, cultivars and hybrids. Add synonymy, common names, trade names, groups, series, grexes, patent IDs, descriptions, native distribution, hardiness, shade tolerance, water requirements, conservation status and more.</td>
</tr>
<tr>
<td>Garden Layout</td>
<td>Garden locations can be recorded from a defined garden area or theme zone down to pinpoint map location with options to record bed, grid numbering and map shape files.</td>
</tr>
<tr>
<td>Institutions</td>
<td>Manage comprehensive lists of institutions and addresses as suppliers or those receiving material through purchase or transaction exchanges.</td>
</tr>
<tr>
<td>Accessions</td>
<td>Store accession records including details of the type and quantity of material received, who and where from, the original or derived source, and the initial identification.</td>
</tr>
<tr>
<td>Propagation</td>
<td>Add propagation details for all plants including cuttings, grafts and seed - linking this to production propagation to supply garden plants.</td>
</tr>
<tr>
<td>Plant records</td>
<td>Add plant records, linked to accessions, storing all details of plants in the garden from planting out to their disposal, loss or death.</td>
</tr>
<tr>
<td>Plant events</td>
<td>Events for plants can be recorded. Examples are plant maintenance and stock-checks; name changes; observations on leaf flush, flowering, fruiting, disease and cause of death.</td>
</tr>
<tr>
<td>Plant requests</td>
<td>Requests can be logged in the plant management requests file with their ongoing status.</td>
</tr>
<tr>
<td>Transactions</td>
<td>Manage incoming material, garden exchanges and other transaction categories as defined.</td>
</tr>
<tr>
<td>Vouchering</td>
<td>Vouchers may be added from original wild collections and/or established garden plants.</td>
</tr>
<tr>
<td>Images and Documents</td>
<td>Link images and documents to accessions and plants (physical files or media library URLs).</td>
</tr>
<tr>
<td>Legal</td>
<td>Add details of all permits and related documentation for the acquisition and exchange of material.</td>
</tr>
<tr>
<td>Query/Report</td>
<td>Query on any table or field using simple or compound saved query commands.</td>
</tr>
<tr>
<td>Map</td>
<td>Map the location of garden plants using the in-built ArcGIS API or using your preferred GIS.</td>
</tr>
<tr>
<td>Online</td>
<td>Publish a virtual botanic garden or online plant catalogue.</td>
</tr>
</tbody>
</table>

Summary of the key components used in the living collections module.
Changing the collection category to Living Collection reveals the relevant menu options for these data.

The key tables and relationships associated with the Living Collections module.

**Administration: setting access and permissions**

Video: [Editing user access and permissions](#)

In most botanic garden projects, there is a need to assign access rights per user for different components of the database. For example, some users may be permitted to edit species records, others not. You may have users allowed to create new transactions. You may have a requirement for visitors who explore and query your database but make no edits.
Access and permission options are described in the manual section on managing user accounts and their permissions.

Species names in horticultural projects

Video: using the species form

Introduction

Information about taxonomic names from higher levels down to infra-specific ranks is provided in the main taxa section of this guide.

This shorter section summarises some of the details with special relevance to botanic gardens and cultivated plants names.

The taxa dictionaries lie at the heart of BRAHMS. Building and maintaining good quality lists of names is important and leads to a healthy database. BRAHMS has an extensive set of features and functions to manage names at all ranks and levels. You can import names from various sources, add your own, develop name lists based on collection data and verify names dynamically using several useful web based resources - or your own external dictionaries.

For botanic gardens and horticultural projects, the priorities for name management tend to be different to museum and research projects. There is a greater emphasis on storing names of cultivated plants, hybrids, common and trade names for families and species, succinct descriptions of the natural distribution of taxa and their horticultural properties.
Species features

Video: adding text entries to taxa

You can store as many facts about species as you want. For example, you can add multiple common names, conservation status, CITES and red list details, range, habit and hardiness. If relevant to your project, you can store more complete taxonomic profiles that may include synonymy, publication details, nomenclature notes and literature links. Links can also be added to online resources. If any taxa-related storage fields you require are lacking, these can be added to your database as custom fields.

You can also store descriptive texts for names at any taxonomic level and subsequently include these in reports. Examples are general plant descriptions, local and/or global distribution notes, conservation status, ecology and plant uses. In nurseries and botanic gardens, the focus may be on more practical issues such as best germination practice, optimal treatments in seedbeds and nurseries, compost mix, stress tolerance (drought, frost), pruning regimes and other useful details, all of which can be searched on and included in formatted reports. Another use of the species file would be to build up details for education programmes with a focus on topics such as how a plant is used locally, poisons, the origin of the Latin name, how it reproduces and what are its close relatives.

Left. Horticultural features can be added using the standard fields provided. Additional custom fields can be added if needed. Right. Text (linked to source references) can be added under any text definition you register in the database.

Making species groups

You can create taxa groupings and maintain these as part of your database. This topic is described in the section on Tag Groups. Example groups could be ‘Native species’, ‘Medicinal species’, and ‘Fragrant species’.
An example use of tag grouping. This group has all taxa with Red List status.

The calculated Full Name field

Video: updating and viewing calculated fields

As you edit a name in the data grid or on the form, the #Fullname (calculated full name) is auto-updated. This field is effectively the complete taxa name with some formatting added. In reports, the name would have further formatting features such as italic for Latin names.

Examples where the lowest ranked author is included.

A completely fictitious name calculated from the data grid data, all authors excluded. The #calculated Full Name in this case: 
Cupressus grexname gx name1 subsp. name2 var. name3 subvar. name4 f. name5 subf. name6 (TestGroup Group) [TestTradeEpithet] 'cultivarname' (TestTradeSeries Series) Hairy Leaves [1]

Bear in mind that your configuration settings control whether author names are included in these calculations. Furthermore, although your overall setting is to exclude authors or include last ranked authors only, you can force include authors on a species by species level, normally this would be used for homonyms or near homonyms.

The force author fields in the main taxa table override other system settings.

Adding and editing accession records

Introduction – Accessions vs Plants
Accession records include details of the type and quantity of material received; from who and where from; the ‘received as’ species name; its wild origin if known; and other details about the material, as available. To see all the fields available, the best procedure is to select Collections > Accessions, assuming the Category ‘Living collections’ has been selected, then select Grid Tools > Manage Columns. Here you can scroll down the entire field list. An accession record is always one species. If your concept of accession covers multiple species, you would need to add a different accession for each species.

Once processed and propagated as needed (perhaps over several years), the accession will then potentially lead to one or more garden plants. The plants records themselves have different descriptive fields, for example, the living status, garden location name, map reference and planting date.

Accession and plant numbering

Accession number formatting is optionally controlled from the settings on System > Options > Living Collections. Here, you can opt for free text entry (no rules) or choose a set of rules to define numbering. These rules apply when new accession numbers are added to the system.

Optimising the adding and editing of Accession data

You can add/edit accession data directly to the data grid or via the form using the standard Add option found on the Data Tools toolbar. You can also batch add data using RDE for living collections.

When you add new accession records to your database, depending on your configuration settings, this will either append a blank record or open the form that calculates the next available number for the selected year (see Accession and plant numbering).
Assuming you are not using RDE, the routine process for adding new accession records can be optimised in a number of ways:

1. Ensure your **configuration settings** are correct.
2. Establish one or more visible column views in the Accession grid to show only the fields you want, and in the correct field order.
3. Ensure that your lookup lists are filled to minimise typing and to reduce error. Bear in mind that you can set fields to force the use of a lookup and/or have free data entry.
4. Learn to use the **short cut keys** provided in Shift+F1.

**Video:** Selecting visible columns

An example living accession data grid with form opened.

**Import default living collection lookup dictionary**

You can import commonly used lookup values related to living collections. These will be added to your custom lookup dictionary.

Most gardens share a common set of lookup values for many standard fields. For example, Provenance Type is U W G or Z.

The custom dictionary is opened from **Management > Lookup Lists.** Lists can be appended using the **Import from Excel** option on the Management toolbar.
A typical lookup option

A typical example of using lookups is provided here. In the case of provenance type, most gardens use a standard coding system: W, G, Z, U. As these are single letters, frankly it’s faster to type in the letter rather than use an elaborate lookup. However, you will probably not want a user to add an incorrect value such as ‘Y’.

To do this, you can select Management > Lookup fields and locate the field name ProvenanceType. If this field is not registered in the lookup list, see below. The settings here will force a user to choose a value from your lookup list (Must Choose) but will also allow the user to leave the field blank (Not Nullable is not selected).

Lookup field settings.

Register a missing lookup field

If you are working in the data grid (main table or RDE), and decide you want to create or edit the lookup values, all you need to do is select the Edit Lookup Values option on the toolbar.

This option can be used to register a new lookup field, set its properties (e.g. force a user to choose a value) and add or edit the data values you want to make available.

This can be used in conjunction with the cleaning up option below.

Summarise and clean-up a data field.

The Summary option is not only a handy tool to list all the values in the current data column – but you can also use this to clean up your data by merging same values.

Video: Merging values - a fast way to tidy your data

In the above example, the Status field is rather messy. This can quickly be cleaned up using the merge facility on the summary tool.

**Editing species names for Accessions**

Species names are stored in the Accession record and must be edited here rather than in the plant record. To edit a species name for an accession or its linked plants, open the Accession table and use a look up function here. Species, as with some other larger tables, have their own special lookup function. The species lookup will hunt for a name in your main dictionary – you can use the Find option to enter a few letters of any part of the name – or if you prefer, the yellow grid filter bar options.

Locating a species is extremely efficient, even when you have many 1000s of names.

If you want to record determination edits more formally, use the Identification tab on the Accession form. Here, you can record multiple names for an Accession, with details of who provided the name changes.
**Wild origin**

The wild origin of an accession can be registered from the **Wild Origin** Tab on the accession form. This effectively links the accession to a collection event. Note that the event itself may have physical specimens.

The accession record also has text fields to describe the origin.

**Supplier details**

The names and address of institutions, plant and seed suppliers, and others you have links to are added to the main address table under **Management > Address Book**. The table can be edited directly in the data grid and/or using the form.

*An example entry in the Address Book*

*A section of the Accession table form showing the lookup option for supplier names.*
**Calculated fields for accessions**

As with many other tables, the Accession table has some handy calculated fields which can be updated using the **Recalculate** option on the Data Tools toolbar. Calc fields can be selectively enabled using Manage Columns or you can view them all using **#Calc Fields** on the Grid Tools toolbar.

An example showing some of the # calculated fields in the main accession table, here sorted by the total number of linked plant records.

**Plant summaries per accession**

A quick way to view all plant records for a given accession is to use the **Plant Summary** tab on the Accession form. This provides a summary of the accession origin and a grid list of the plant records.

The visible plant list fields can be adjusted by right-clicking on the grid header. Grid filters can be used.

**Propagation**

**Introduction**

When an accession arrives as seed or bulbs, a graft, a cutting, a living plant or other type of propagule, it is either planted directly into a collection in the garden or it is kept in production until it is moved to a permanent site in collections. When the accessioned material is kept in production to grow on, inventory and production information can be recorded to include the following:

- **Finish number**: enter the number of plants to finish. If more than one person wants finished plants enter the total number of plants to finish.
- **Finish size**: enter the size the plant needs to be when it is ready to be planted into the garden; e.g. dbh, pot diameter, etc.
- Propagation date: the date the material entered production. The default date is the date the production record was created.
- Propagation location: where in propagation the propagules are located, e.g. greenhouse 3.
- Container type: the type of container at the time of accessioning (ex. packet, mist bench, etc.)
- Prop count: the number of plants from the Quantity received field on the Material tab.
- Check date: the check or inventory date. The default date is the date the record was changed.
- For who: the name of the person who assigned the finish number. If more than one person wants finished plants enter the names followed by the number requested. NOTE: If you do not find the correct name you will have to create a new name (People > View/edit people records).
- Check date: the date of accessioning.

**Seed propagation**

The seed propagation table and form provide a way to keep track of how each seed batch was processed and the success rates. Entries can be kept for stratifications and emergences with various fields including the number of days between stratification treatments and the % germination success being auto-calculated. Each accession may have multiple seed propagation trial entries.

If needed, it is possible to store further seed testing details in the seed module.

**Cuttings propagation**

Propagation details for cuttings can be recorded with one or more propagation record per accession.
A sample cutting propagation entry. Fields such as the Cutting Type, Medium, Cutting location and Hormone Prep Type have lookup lists to select values from.

**Graft propagation**

As with cuttings and seed, propagation details for grafts can be recorded with one or more propagation record per accession.

A sample graft propagation entry. Fields such as the Root Stock Type, Graft Type and Callus Location have lookup lists to select values from.

**Production propagation**

Basic propagation details are added here. Each accession may have multiple propagation records. In particular, the record documents how many plants are to be prepared for the garden, the propagation date and who the plants are for.
Plant records

Introduction

The main plant file stores details of all plants that are or have been growing in the garden with details including the plant status (alive, disposed, etc.) planting date, garden location, vouchering, label requirements, identification changes, commemoration or sponsorship details, and mortality details.

Plant records in turn are linked to an accession record which holds all the information about the origin of the plant, the supplier and/or wild origin, its propagation history and of course, the identification.

Setup options

As certain calculations refer to the plant status code, BRAHMS has to know which code or text you use to represent an active accession or living plant (i.e. current status = alive) in the plant record Living Status field, for example ‘A’ or ‘Alive’. To edit this code or text, select System > Options > Living Collections.

Propagation data can be added and edited from the plant accession table. In this example, the accession has 1 propagation entry and the user (in Edit mode) is editing this entry (Propagation Data Editor form).

Propagation data can also be edited directly in the production propagation table.
Setting status codes for accessions and plants. The Alive coding is used by BRAHMS when calculating the ‘alive plants’ field in the species table – these are used as a quick references in the species table.

Plant numbering

Each plant record has a unique identity number. This number may include the accession number followed by ‘*plant number’. For example, 2019-001*1, 2019-001*2, 2019-001*3. But this is configurable. Refer to the section on accession and plant numbering.

Editing the plant table

The main plants table

Opened from Collections > Plants (assuming the Category Living collections has been selected).

An example living plants data grid with form opened.

Lookup list settings for status codes and other fields

The process is discussed in some detail here as the same processes can be used to create lookup lists for other fields elsewhere in BRAHMS. More information about this topic is available in the section on lookup lists.

Status codes for accessions or plants are typical of fields that often have a set list of values. For plant records, they may be Alive, Lost, Dead, Disposed, … optionally represented by shorter codes such as A, D, L. Different projects have their own coding system. Normally, you will want to ensure that if a value is selected, it comes from your list of options rather than being entered as free text. This keeps the database in good shape and avoids multiple entries that refer to the same thing.

The list of values you choose can be added to your ‘lookup list’ dictionary. This is the central dictionary that manages values for the entire database.

There are two main ways to develop the look up lists:

Firstly, if you already have Plant Status codes in your plants table, you can use these data to auto-build a lookup list. To do this, select Collections > Plants to open the main plant table, locate and click anywhere in the
field Plant Status and then select **Edit Lookup Values**... on the **Data Tools** toolbar. This option allows you to select which of the current data values you want to register as lookup values – this may be all the values you currently have - or a selection of them.

![Image](image.png)

**An example where the plant file has status values but none are currently registered in the lookup list on the right.**

Before using this **Edit Lookup Values** option, you might want to tidy up any current entries in the Status field using the **merge option** on the **Summary** tool.

![Image](image.png)

**The columns summary tool allows you to merge and thus tidy up values in a given column. In this case the entry LIVe will be merged to LIVE.**

You can also edit the look up list directly from **Management > Lookup Lists**. Records added here with the correct entry in the Field Name column will appear in your lookup list. Also note that you can **import values from Excel tables**.

![Image](image.png)

**In this example, the correct Field Name entry is LivingStatus – no spaces and in the correct case. As explained in the lookup list section, you can choose to use the abbreviation or full value when selecting a value to add to a table.**
**Calculated fields for plant records**

The species and plant tables have a number of plant-related calculated fields refreshed using the **Recalculate** option on the Data Tools toolbar. As with all tables, you can either selectively add calculated fields using **Grid Tools > Manage Columns** or switch them all on using **#Calc Fields** on the Grid Tools toolbar.

![Species table with calculated fields]

An example in the main species table where the calculated fields #Living Alive is set to visible. This calculates the number of living plants per species. Calculated fields are updated using the **Recalculate** option on the Data Tools menu.

**Garden areas and plant locations**

Garden plants can be linked to a garden location record. These location records are in turn linked to garden areas records thus creating a hierarchy. Each area and location record can have map references and map shapes files, the name of the responsible curator and other details as appropriate.

![Diagram showing garden areas, garden locations, and plant records]

The way the garden location tables and fields are used varies by project. For example, the Garden Area table may be used to store the name of difference gardens in a multi-garden project. Alternatively, it can be used to classify the key divisions of a larger botanical garden or arboretum. All of the fields listed below are optional.

**Main garden areas/divisions**

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag</td>
<td>Standard tagging field</td>
</tr>
<tr>
<td>Del</td>
<td>Standard deletion field</td>
</tr>
<tr>
<td>#Localities</td>
<td>Calculated field: number of linked localities</td>
</tr>
<tr>
<td>#Images</td>
<td>Calculated field: number of linked images</td>
</tr>
<tr>
<td>Major Garden Area Name</td>
<td>Name of the main area/zone</td>
</tr>
<tr>
<td>Area Location Code</td>
<td>Code if one is provided</td>
</tr>
<tr>
<td>Area Status</td>
<td>Status code</td>
</tr>
<tr>
<td>Aspect</td>
<td>Area aspect</td>
</tr>
<tr>
<td>Grid</td>
<td>Area grid reference</td>
</tr>
<tr>
<td>Elevation</td>
<td>Min and Max altitude</td>
</tr>
<tr>
<td>KML file</td>
<td>Shape file</td>
</tr>
<tr>
<td>Prefix</td>
<td>Text prefix for area name (can be used in e.g. reports)</td>
</tr>
<tr>
<td>Curator</td>
<td>Name of area curator</td>
</tr>
<tr>
<td>Comments</td>
<td>Comments</td>
</tr>
<tr>
<td>Audit fields</td>
<td>Standard audit fields</td>
</tr>
</tbody>
</table>

**Garden localities**
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag</td>
<td>Standard tagging field</td>
</tr>
<tr>
<td>Del</td>
<td>Standard deletion field</td>
</tr>
<tr>
<td>#Living Alive</td>
<td>Calculated field: number of linked plants with status Alive (or equivalent)</td>
</tr>
<tr>
<td>#Living Other</td>
<td>Calculated field: number of linked plants with status other than Alive</td>
</tr>
<tr>
<td>#Families</td>
<td>Calculated field: number of families in location (from plant record links)</td>
</tr>
<tr>
<td>#Genera</td>
<td>Calculated field: number of genera in location (from plant record links)</td>
</tr>
<tr>
<td>#Taxa</td>
<td>Calculated field: number of taxa in location (from plant record links)</td>
</tr>
<tr>
<td>#Wild Derived</td>
<td>Calculated field: number of plants with Provenance Type = W</td>
</tr>
<tr>
<td>#Cultivated derived</td>
<td>Calculated field: number of plants with Provenance Type = Z</td>
</tr>
<tr>
<td>#Images</td>
<td>Calculated field: number of linked images</td>
</tr>
<tr>
<td>Garden Area Name</td>
<td>Name of the parent major garden area</td>
</tr>
<tr>
<td>Locality Type</td>
<td>For example, Landscape collection, Horticultural collection, ...</td>
</tr>
<tr>
<td>Garden Zone</td>
<td>Optional zone or theme name – can be used as an extra divisional name</td>
</tr>
<tr>
<td>Garden Location Name</td>
<td>Name of the garden location</td>
</tr>
<tr>
<td>Area Location Code</td>
<td>Location code if one is provided</td>
</tr>
<tr>
<td>Area Status</td>
<td>Status code</td>
</tr>
<tr>
<td>Aspect</td>
<td>Location aspect</td>
</tr>
<tr>
<td>Grid</td>
<td>Location grid reference</td>
</tr>
<tr>
<td>Latitude/Longitude</td>
<td>Map reference fields also with datum, resolution, origin...</td>
</tr>
<tr>
<td>Elevation</td>
<td>Min and Max altitude</td>
</tr>
<tr>
<td>KML file</td>
<td>Shape file</td>
</tr>
<tr>
<td>Prefix</td>
<td>Text prefix for area name (can be used in e.g. reports)</td>
</tr>
<tr>
<td>Curator</td>
<td>Name of area curator</td>
</tr>
<tr>
<td>Comments</td>
<td>Comments</td>
</tr>
<tr>
<td>Audit fields</td>
<td>Standard audit fields</td>
</tr>
</tbody>
</table>

**Plant table location fields**

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Name</td>
<td>From parent major garden area table</td>
</tr>
<tr>
<td>Location Name</td>
<td>From parent garden locations table</td>
</tr>
<tr>
<td>Subarea 1</td>
<td>Area Division 1</td>
</tr>
<tr>
<td>Subarea 2</td>
<td>Area Division 2</td>
</tr>
<tr>
<td>Grid</td>
<td>Grid Area</td>
</tr>
<tr>
<td>Sub Grid</td>
<td>Sub-Grid Area</td>
</tr>
<tr>
<td>Garden Bed</td>
<td>Bed number</td>
</tr>
<tr>
<td>Row Number</td>
<td>Row number</td>
</tr>
<tr>
<td>Sequence</td>
<td>Sequence (e.g. for inventory or trail)</td>
</tr>
<tr>
<td>Latitude /Longitude</td>
<td>Map reference</td>
</tr>
<tr>
<td>Elevation</td>
<td>Min/Max altitude</td>
</tr>
</tbody>
</table>

**Disposal and mortality**

Records of plants that die or are disposed of are usually maintained in the plant file. Clearly, over time, the % of dead plants in the database increases. It is possible to remove these records, perhaps after making an archive backup.

Dead or disposed plants will have the appropriate status coding added to the Plant Status field. The small colour coded square on the top right of the form is displayed in red.
Dates and causes of mortality and/or loss can be recorded using a form tab.

**Sponsorship, commemoration and tributes**

Individual plants can have commemoration texts added.

It would also be possible to design and save a data grid field view showing the relevant fields as shown here. This would allow sorting, filtering and rapid editing of these fields.

**Using tag groups with plant records**

The [Tag Groups function](#) can usefully be used with plants to create groups of plants of species interest. Any selection of plant records can be tagged and this then used to create a names plant group.
Tagging plants based on tags in other tables

Another handy feature used throughout BRAHMS is the Tags > Transfer Tags tool which transfers tags from a table to any related tables. Thus, you may have a set of tagged records in the species table (perhaps restored from a tag group e.g. ‘Native taxa’). You can then use Tags > Transfer Tags to copy the tags to all plant records of the tagged species. Read about transferring tags.

Plant Events

Introduction

Living collection plant event records are used to record things that happen to plants from their acquisition through to death or disposal. Examples are plant movements, fertilizing, mulching, making safe, spraying and tree surgery. You can also store observations such as flowering and fruiting times. As each event has a date, these can later be reviewed and used to analyse phenological and other patterns.

Events are stored in a separate file linked to the main plant file. A plant record may have many registered events, sorted chronologically. Although stored in a separate table, all events can be quickly listed from the main plant form.

The events table is often the largest and most actively edited table in the living collections module. The choice of which events to record is entirely a decision for each project.

Event categories and other fields

Events are categorised in a user defined, 3-level hierarchy:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PlantID</td>
<td>The event record display some fields from the parent Plant file including the ID itself, the species location.</td>
</tr>
<tr>
<td>Event Types</td>
<td>This is the top grouping level – thus there will usually be a small number of entries. Examples are Inventory, Maintenance and Observation.</td>
</tr>
<tr>
<td>Event Groups</td>
<td>These are division of the main event types. Thus, for maintenance, you may have entries such as Fertilizer, Herbicide and Mulching</td>
</tr>
<tr>
<td>Events</td>
<td>These are the final category which would be, for example, the different types of mulching such as bark-chips, pine-needles or limestone.</td>
</tr>
<tr>
<td>Event Date</td>
<td>Separate into Day Month and Year fields.</td>
</tr>
<tr>
<td>Result</td>
<td>Where relevant, a text or numeric entry relating to the event, for example a measurement.</td>
</tr>
<tr>
<td>Event Person</td>
<td>Who carried out the event</td>
</tr>
<tr>
<td>Event Notes</td>
<td>Text description of event</td>
</tr>
<tr>
<td>Audit fields</td>
<td>Added by, Added When, Last edited, Last Edited by</td>
</tr>
</tbody>
</table>
Registering your event categories in the lookup list

Entries for all three levels should be registered in your lookup list.

Sample lookup list entries for plant events.

Typically, the top level Event Type will consist of a short list. One of the entries may be ‘Maintenance’. This is the top level in the event hierarchy. Note that the Field Name is set to EventType and there is no entry needed in the Parent Value field.

Event Groups are also registered in the look up list. Each entry has an Event Type as a parent. The parent event type is added to Parent Value field as shown above. The example here lists entries for ‘maintenance’. One of the maintenance-related entries is ‘mulch’. Note that for ‘mulch’, the Field Name is set to EventGroup and the Parent Value is set to ‘Maintenance’. Finally, the entries for the field Event are listed, here for ‘mulch’. Note that the Field Name is set to Event and in this case the Parent Value is set to ‘mulch’.

This set up will then allow you to correct use the lookup options when adding and editing events.

Editing Plant Events

Events can be edited directly from the main Plant Events table opened using Collections > Plant Events.

Events can be added and edited directly in the events table. If you add a new record, you are prompted for the plant ID. Several fields from the plants table are displayed but cannot be edited in the events table.

Alternatively, you can edit events using the main plants table form - Events tab.
When using this form, events are listed for the current plant record and these update as you move through the data grid. You can add and edit events here too.

When editing events, the lookup option for the event entry uses a hierarchical value selector. The top Find option allows you to enter efficient strings and with some practice, you can minimise typing to locate the required entry. The example here uses ‘m’ to restrict to maintenance, ‘c’ to restrict to chemical and then ‘h’ to find herbicide. Clearly, how you search will depend on the values added to your look up list.

Creating an RDE table for plant events

While events can be added directly to the database, if there are many events to add, it will be faster to use an RDE file plant events file. This is a spreadsheet which can be edited, checked and then imported to your database. The process of using RDE (Rapid Data Entry) is described elsewhere in this guide.

There are two ways to create RDE plant event files:

   a) Create a file directly in the RDE manager using Rapid Data Entry > Create new RDE file, choosing the category ‘Plant Events’.
   b) In the main living plants table, use the tool Tag -> Events RDE which can be found on the Collections menu.

The advantage of using the collection tools option Tag -> Events RDE is that the RDE file is created pre-populated with the plant records you want to record data for.

- Open the main plants table using Collections > Plants (this assumes the collection category is set to ‘Living Collection’).
- Tag the records to include. Typically, this may be for a selected garden area. To do this, apply a filter for a selected garden area (or several garden areas) – and then use Tag > Tag all.
- You can now use the Collection menu tools option Tag -> Events RDE.
Use Tag -> Events RDE to create an RDE file pre-populated with the plant records you want to work with. This file can then be edited with the event details (observations, maintenance, annotations, status checks, etc.). After checking, the file can then be transferred to BRAHMS.

**Transferring Event RDE files to BRAHMS**

When you import a plant events file to BRAHMS, the new events will be added and linked to the correct plant records based on the Plant ID. If the Plant ID is not located, the event record will not be imported.

As well as adding events with the event type, group and event, RDE event files can also be used to:

- Change plant status (Alive, Dead, Lost, etc.)
- Change plant identification
- Indicate that a label is required

**Plant requests**

Requests (plant actions requested) can be logged in the plant request file. Request lookup selections are managed in the same way as events, replacing the Field Name as appropriate. As the lookup lists for requests and events may differ, these are added to the lookup list separately. Requests can be edited directly from the main Plant Events table opened using Collections > Requests. Alternatively, you can edit events from the main plants table using the Requests tab on the form.

**Images and Documents**

**Images**

Images can be linked directly to species, garden plants or indeed, to any other database record. Physical image files can be stored in any accessible location. You can also link images as URLs. Images can also be added via RDE and you can import images from Excel. For more details, refer to the image section of this guide.

**Image management** is discussed in the image section.
Documents

Multiple documents of any type can be linked to taxa, accessions, plants or any record in BRAHMS. Examples are material transfer agreements, collection permits or perhaps a video or slideshow linked to a botanic garden greenhouse record. Refer to the section on linking documents.

Reporting, exporting and mapping

Labels and other reports

The reporting options integrated with BRAHMS allow you to develop any category of report required. Details of report design are provided in the reporting section of this guide.

Video: Printing a garden plant list
Video: Design and print botanic garden labels

A typical report would be for label production. You can design multiple reporting templates for different categories of label and either print directly or export to different formats.

Exporting to Excel and CSV

Data from any table are easily exported to Excel or CSV files.

Video: exporting to Excel/CSV

Tagged records are easily opened in Excel or as CSV.
Mapping garden plants and their origin

Video: https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#gardenmapping

Mapping the location of garden plants only requires that your plant records have a latitude/longitude value. These can be entered in different units but are always stored in decimal degree format, negative for South and West. You can store these data with up to pin-point accuracy.

Using the internal ArcGIS mapper, you can map the plant locations, dynamically linked to the data grid. These mapping options are discussed in the section on the ArcGIS internal mapper. You can also dynamically map your data to other GIS including QGIS, ArcMAP and DIVA GIS.

You may have your own garden base maps to add as map layers – or use map layers available online including world imagery maps. If your map data are available on a map server, you can also add your own map to the ArcGIS API.

Garden data plotted to ArcMAP and the internal ArcGIS mapper
In this example from The Morton Arboretum, a filter is set on garden location ‘Morton East Woods’. The Betulaceae are tagged in red – and the map is set to map Tag colours.

As with other map points, garden plant map points can be added or edited using the Map Point Editor. This function is described in the section Adding and editing map points.

A right-click on the map moves the point and adjust the stored data point.
Transactions – recording the movement of materials

Video: https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos#transactions

Introduction

Transactions monitor incoming and outgoing loans, gifts, exchanges, and other transaction categories as you define. They maintain a permanent record describing the movement of physical specimens, plants or other items.

As well as providing longer term benefits that come from tracking the movement of collections, the transaction module has immediate practical uses: printing lists, pinpointing the whereabouts of particular collections; balancing specimen numbers in herbarium exchange schemes; listing loans overdue; and preparing transaction period activity reports. The module also provides a logical platform to record in-coming determinations. As specimens return from loans, revised determinations can be efficiently updated and fed into the main database.

Frequently, the need to record which specimens are being dispatched on loan is an incentive to databasing collections, providing a realistic way to making a start with this often massive and daunting task and at the same time doing something of immediate practical benefit. To make full use of the transactions module you do not need to have a fully databased herbarium – you can start today.

Herbaria using barcodes can make good use of these with the transaction module. Barcodes are used to select individual specimens. Barcodes:

- Provide extra precision with the handling of collection materials.
- Save time selecting collections for dispatch and recording returns.
- Can be included on specimen lists providing an unambiguous specimen reference.

Adding a sample transaction

The demo database does not include transactions data but you can test by adding a dummy transaction record and linking some specimens to it. Normally, barcodes would be used for certain tasks here, for example selecting material to link to a transaction or marking material as returned. As you do not have the barcoded material, we can use alternative methods.

- Select Management > Transaction categories. This table includes the categories of transaction you wish to manage. This example will choose ‘Loan requested from you - then returned’ therefore you don’t need to add a new category.
- Select Management > Transactions to open the main transactions table. Select Edit to switch to edit mode. You can enter some details into the grid using the F9 lookup key in fields such as Category and Institution Name. You can also use the Form to edit the transaction details.

- Select Collections and choose the Category Preserved Specimen from the dropdown. You can then select Specimens to open that table.
- Now tag some specimens to link to the newly added transaction. You may want to use Tag > Untag first to ensure nothing else is tagged. For example,
In this example, data grid filters have been added for Institute Code and # Full Name to select all specimens at FHO of Agathis ovata. These records have all been tagged using Tag > Tag all.

- Finally, select the main Collections menu again and then use the option Tag > Trans. This will link the tagged material to the selected transaction. You can see the result by returning to the transaction file and opening the form on the Data Tools menu.

Linked specimens listed on the main transaction form. Determinations can be edited here as material is returned.

Barcode scanning is normally used to link/unlink material as well as mark material as Returned.

Note also that images linked to specimens can be published to virtual loans via BRAHMS online.

Publishing transactions online
Permits and permissions

Introduction

The Legal option on the Data Tools toolbar provides access to all details on permits, permissions and other issues related to the legal status of material and its movement.

The options provided here relate to the legal status of materials in your collection allowing you to store details on permits of different types, including links to related documentation such as material transfer agreements and notes on due diligence. Entries can be categorized as Nagoya (2014 onwards), CBD (1991 – 2014) or pre-CBD.

Permits and Permissions records can be linked to physical specimens, plants or seed collections.

A sample permits and permissions form. Documents associated with the record can be dragged to the lower panel.
**Collection, Nagoya, Import, Export, Research and Phytosanitary**

The following heading for permits are provided: Collection, Nagoya, Import, Export, Research and Phytosanitary. In each case, you can add permit numbers, the issuing authority, dates and notes. You can also link documents such as PDF or scans to each entry.

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS) to the Convention on Biological Diversity is a supplementary agreement to the Convention on Biological Diversity. The Nagoya Protocol on ABS entered into force on 12 October 2014. It provides a transparent legal framework for the effective implementation of one of the three objectives of the CBD: the fair and equitable sharing of benefits arising out of the utilization of genetic resources thereby contributing to the conservation and sustainable use of biodiversity. See [https://www.cbd.int/abs/about/](https://www.cbd.int/abs/about/)

**Due diligence**

'Due Diligence' entries can be added for any permits and permissions entry with the date, the name of the person undertaking the due diligence and notes. Documents can be linked.

**Species protection and legal status**

CITES, Red List and other notes about species are added to species records directly.

---

The main species table filtered on accepted names, sorted by family+ species. A column view named 'red list' has been saved and is here selected.
Publishing online with WebConnect

**Introduction**

Many projects are under increasing pressure to publish their data online or simply want to share their data with the wider community. This section explains how you can create and edit your own websites and upload your data and images directly to BRAHMS online. The module connecting BRAHMS to BRAHMS online is known as WebConnect.

**BRAHMS online**

BRAHMS online (BOL) is a unique website service created for the BRAHMS project. It is used to publish BRAHMS databases online and/or to describe and promote your project. BOL websites can be richly developed with text, images, hyperlinks, tables, file downloads and indeed any standard website feature. Websites can be linked to one or more BRAHMS databases and the online data query tools search these data and present the results in flexible text pages and data grids. You can see example screens and websites on: [https://herbaria.plants.ox.ac.uk/bol/brahms/publishonline/bolfeatures](https://herbaria.plants.ox.ac.uk/bol/brahms/publishonline/bolfeatures) and [https://herbaria.plants.ox.ac.uk/bol/brahms/publishonline/websites](https://herbaria.plants.ox.ac.uk/bol/brahms/publishonline/websites)

![Example screenshot of a website](image.png)

An example of a content rich, BRAHMS online website: [http://brahmsonline.kew.org/msbp](http://brahmsonline.kew.org/msbp) - the website site design and data uploads were processed via WebConnect.

**BRAHMS online servers**

BRAHMS online websites can be can be developed and published on any computer where the BRAHMS online system is installed. You can create websites on the BRAHMS server located in Oxford (requires license) or on another server that has BOL installed. Many projects choose to install BOL on a server within their own institution.

Server location influences the URL address of your website. You may want to install BOL on your own server and register a meaningful Domain Name System (DNS) for the server such as [http://newworldfloras.org](http://newworldfloras.org) and thus be able to have a URL such as [http://newworldfloras.org/ericaceae](http://newworldfloras.org/ericaceae). Read more on e.g. [http://en.wikipedia.org/wiki/Domain_Name_System](http://en.wikipedia.org/wiki/Domain_Name_System).
**BRAHMS WebConnect**

WebConnect is the software that connects your BRAHMS system to BRAHMS online allowing you to develop and edit websites and upload selected data and additional resource files. Using WebConnect, you can manage security settings, control access, logins and downloads. Web design uses bootstrap with each site having its own CSS file. WebConnect options are accessed in BRAHMS from the PublishOnline menu.

---

This section of the manual is not completed.
Database maintenance

Re-indexing databases

Re-indexing can increase the efficiency of a database, especially after heavy editing.

SQLite databases

Select System > Manage Data connections ..., highlight a local file system (database (Personal, Conifers or any SQLite database you may have created) and then select Edit > Re-index.

Re-index option for SQLite databases.

MSSQL Server

We have not yet automated this process from BRAHMS but in the meantime, database admin can run the following query script against the relevant database(s) – this script is for 2012 or later.

EXEC sp_MSforeachtable @command1="alter index all on ? REBUILD WITH (FILLFACTOR=80, STATISTICS_NORECOMPUTE=ON);"

GO

Execute the above query against the database to optimise. This could be set to run as an automated (overnight) query on servers.

Backing up your data

Introduction

Backing up is the process of copying valuable files to a safe place in a systematic way. There is only one way to absolutely ensure the safety of your data – rigorous adherence to a regular program of backing up of your data. It is a nuisance to backup but this is a much better alternative than the loss of your data.

Be warned that some projects get their fingers burned badly before they take backing up seriously. Years of hard work can be lost in different ways - here are some possibilities:
• A computer may be stolen.
• A computer disk may malfunction or crash with loss of all data on that disk.
• Files on a computer may be deleted by mistake.
• Files may be corrupted by a hardware fault or a power failure.
• Data files may be progressively damaged by an undetected software fault.
• You may make one or a series of complex editing errors.

Copy your files to a different disk/storage media. If you backup to the same storage media (e.g. your hard disk), all your eggs are in one basket. Do not continually backup to the same backup file, this overwriting the last backup. If you do this, you may end up overwriting a good backup with bad data.

Creating backups - which files?

Minimally, you need to backup files that have been edited.

Backup your main database file(s). This will be the database or databases as registered in your database connections (SQLite, MSSQL Server, PostgreSQL files).
• Backup your RDE files – there are always SQLite files, only one file per RDE.
• You should also keep copies of report templates – wherever these are stored.

Backup rotation and frequency

In the ideal world, you should never overwrite a backup, but rather, keep a continuous record of your data as it changes right from the start in a growing series of archived backups. A continuous series of backups is your strongest defence against data loss. Should an unexplained, perhaps systematic error creep into your database, you may need to step back in time, backup by backup until you find the beginning of the problem. In many cases, however, this may be unrealistic – disks will be re-used and backups overwritten. Try to rotate storage media in a sensible way. Always keep at least some regular backups that are not overwritten. The frequency of backing up depends on the rate of data entry. If you are editing your main database every day, you may want to back up every day. RDE files should always be backed up after a data entry session.

Automated backup on server

Server administrators can set up scripts to automate database backup creation.
Annex 1. Upgrading BRAHMS v7 to v8

Checking your v7 database

Please follow each of these steps carefully. Errors in v7 will cause the transfer to fail.

- Your BRAHMS 7 version should be 7.9.14 (August 2019) or later. The version is displayed on your log in screen. Earlier versions must be upgraded.
- Log into a copy of your v7 database. While not essential, it will be better to use a database copy as some minor changes are made to the database structure.
- Select Admin > Project configuration > Indexing and make sure the setting is Machine rather than General. If it was General, switch to Machine and re-index your database.
- Re-index your database. If any data errors are reported (e.g. month value 13), you should fix these now. For example, you may get a message box indicating errors in some fields as follows:

```
DETMONTH, LAT, LONG, GAZ LAT, GAZ LONG
```

If you see such warnings (indicating incorrect numeric values), follow the screen message to locate the data and remove these errors. Such errors may cause the transfer to v8 to fail.

The re-index in v7.9.14 or later checks for further errors and irregularities. For example, it may be that older v7 databases have rogue link file records; rogue entries in the ’people link’ file; or incorrect synonym links in your species file. Follow the screen instructions to correct reported errors.

- Select Admin > BRAHMS tables, record totals and database integrity.

If your database has any errors, these must be resolved before you transfer. If you do not remove these errors, the transfer will fail. If you need help with this stage, contact the BRAHMS project.

Adding a database description

Select File > Database manager and ensure you have added entries to the fields:

- DESCRIP (short description of your v7 database)
- COPYRIGHT (if applicable)
- TERMSOFUSE (e.g. "Data not for commercial use")
- CREATEDBY (e.g. your institute or personal name)
- CREATEDON (this can be approximate)

This information will be transferred to v8 and can be edited there later on. If these data are missing, the transfer will request that you return to v7 to edit one or more of these fields.

Checking your v7 link files

Link file fields (custom fields) are transferred to v8. This is a good time to look over your various link files to check if you have unwanted or redundant fields. You may want to remove any redundant link fields prior to the transfer although this can also be done in version 8.

Checking text descriptions

Taxa text descriptions from your v7 family, genus and species files are stored in a different way. Certain v7 memo fields in these files have been moved to a new table in v8, the taxa text descriptions file.

- The following fields are no longer stored in the v8 family and genus files themselves: DESCRIP, DISTRIB, DIAGNOSTIC, WEBLINKS, WEBNOTES, NOTES01-NOTES05.
- The following fields are no longer stored in the v8 species file itself: DESCRIP, DISTRIB, WEBLINKS, WEBNOTES, USES.
These various memo fields are transferred to the new table in v8. However, before exporting your data, you must run the option Admin > BRAHMS v8 data transfer > Prepare taxa text for transfer to v8. Otherwise, data in the above fields will not be transferred. This option does not remove data from the v7 fields – rather it copies the relevant table in v7.

Folder preparation
Create a folder on your workstation to gather the v7 XML transfer files. Any folder name/location can be used. An example is c:\myv8xmlfiles.

Creating the v7 xml transfer files
Log into v7 in single user mode and select Admin > BRAHMS v8 data transfer > Transfer data to v8...

The v7 transfer form.
This phase is where your data are transferred to XML files. Primary and foreign keys are created as new GUID fields. The file creation will take some time with large databases but you can watch the progress in your XML folder as the files build up. Large tables are split into multiple XML files numbered 000, 001, 002, etc.

The recommended settings are the defaults. However, if exporting a very large database for testing only, you can de-select the options Transfer track changes and Transfer record create details as these may significantly increase the export time.

Select Process data to generate the XML files. Progress is reported as it goes through the various v7 tables.

A sample of the types of file you can expect to see in your XML folder

Choice of data store for your v8 database project
With no further installation, you can transfer your v7 data into an SQLite data store. SQLite is more suited for smaller databases.

If you are transferring a large database, it will be better to import your data to MSSQL or PostgreSQL. Instructions on setting up an MSSQL Server or PostgreSQL databases are provided separately.

Although an SQLite data store can store more than one database project, we recommend that you create a new instance of the data store for substantial projects. Thus, while you could import your v7 database into the
default brahms.db SQLite data store or to the store holding the conifer database, it makes more sense to create a separate instance of the SQLite data store.

**Importing v7 xml transfer files to v8**

- Log into v8 using the settings as below – unless you have a BRAHMS username and password assigned.

![Login](image)

- Select **System > Manage Database Projects** ... Then Select **Import** and navigate as prompted to locate the DatabaseProject.xml file in the XML folder created above.
- If you want to speed up the initial import, you can opt to exclude Edit History data – bearing in mind that these data can be imported later on. Otherwise, select the default option **Import Everything**. NB: Edit History includes record addition date, added by and track changes details as recorded/available in v7.
- Select **Save** to initiate the import.

![Database Projects Manager](image)

*Importing progress is displayed.*

If the import process fails, you will have to delete the XML folder and start again. This implies that there was an unresolved error in your v7 database. The import process is all or nothing.... If you are unable to resolve the issue, contact the BRAHMS project.

Once the import has completed, you can **Load** the project. The XML transfer files can be deleted.
Annex 2. Key differences between BRAHMS v7 and v8

While derived from earlier versions of BRAHMS with respect to much of its functionality, v8 is an entirely new system with updated technologies and data store. BRAHMS v7 users will recognise many of the tools and functions in v8 as well as the broad layout of the menus. However, as listed here, there are fundamental differences between these systems.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project management</td>
<td>The BRAHMS project now has additional management support from Oxford University Innovation (OUI) who provide licences for BRAHMS, ensuring users get the correct package and support. <a href="https://innovation.ox.ac.uk/licence-details/brahms/">https://innovation.ox.ac.uk/licence-details/brahms/</a></td>
</tr>
<tr>
<td>Museum management</td>
<td>V8 is no longer restricted to botanical data. The concept of herbarium specimen is replaced by preserved specimen (i.e. museum specimen). <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#nathistory">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#nathistory</a></td>
</tr>
<tr>
<td>Data storage</td>
<td>Data are no longer stored in DBF and FPT files but rather in a choice of stores that are fully up to date with respect to technology and have no meaningful limit to table size. Current options are SQLite, MSSQL Server and PostgreSQL. V8 databases can store and cross reference millions of records. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#performancevideo">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#performancevideo</a></td>
</tr>
<tr>
<td>International</td>
<td>BRAHMS v8 is international with respect to the interface and the data. Data are stored in Unicode with no restriction on the character data stored across languages. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#language">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#language</a></td>
</tr>
<tr>
<td>Temp files folders</td>
<td>There are no longer any temp file work folders. Instead, personal files such as RDE files, saved files, column views and exported data are saved in your BRAHMS folder in Documents.</td>
</tr>
<tr>
<td>Primary and foreign keys</td>
<td>All table key fields use 32 hexadecimal digit GUIDs. They cannot be duplicated and thus remove the danger of duplicating primary keys. Database integrity is assured both by the BRAHMS software and by the DBMS.</td>
</tr>
<tr>
<td>File and field names</td>
<td>Table and fields names have been updated to be more meaningful. V8 is no longer restricted to 10-character field names.</td>
</tr>
<tr>
<td>Modular system</td>
<td>BRAHMS v8 has a flexible, 3-tiered and modular architecture opening up options for shared development. The user interface (UI) is independent of the services and data store access and therefore could relatively easily be substituted by other technologies such as a web-browser UI. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#modular">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#modular</a></td>
</tr>
<tr>
<td>Interface</td>
<td>The new system uses ribbon toolbar technology (context sensitive menus and toolbars) similar to that used in MS Office applications – making it highly intuitive. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#v8menus">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#v8menus</a></td>
</tr>
<tr>
<td>Help</td>
<td>Improved help is built into v8, backed up by online support and training video clips e.g. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#mappingvideo">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#mappingvideo</a></td>
</tr>
<tr>
<td>NULL values</td>
<td>It is possible to store NULL values in all tables.</td>
</tr>
<tr>
<td>Species table and field names</td>
<td>The fields SP1, RANK1, SP2, RANK2 and SP3 have been dropped. V8 has separate fields for species, subspecies, variety, forma and cultivar. Formatted taxa names include the appropriate ranks. The size limit on these fields has been increased. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#taxonnames">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#taxonnames</a></td>
</tr>
<tr>
<td>Higher level classification table</td>
<td>A new table is added for taxon ranks above family. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#taxonnames">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#taxonnames</a></td>
</tr>
<tr>
<td>Extract files</td>
<td>V8 does not have the equivalent of extract files. Instead, your selections are seen in the main tables after applying a query.</td>
</tr>
<tr>
<td><strong>Queries and filters</strong></td>
<td>Query and filter functions are one and the same thing. Both now use standard SQL commands and have exactly the same result. There is no longer a fixed menu of query commands. You can design and save your own commands. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#explore">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#explore</a></td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Tree Views</strong></td>
<td>Tree Views are now available in all tables. You can also design and save your own multi-level Tree Views. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#treeviews">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#treeviews</a></td>
</tr>
<tr>
<td><strong>Link fields</strong></td>
<td>Link fields in v7 are now referred to as custom fields. These fields can be added to all tables and rather than being treated as add-ons, they become a more integrated part of your database. For example, they are added to the main data grids rather than optionally appearing below the grid. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#custom">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#custom</a></td>
</tr>
<tr>
<td><strong>Lookup list</strong></td>
<td>The v7 custom look up list table is now separated to two tables: look up fields and look up values. The field list includes meta data about the lookup fields such as whether there is forced lookup or free text entry is permitted. The values table has entries for all lookup values – abbreviations are no longer used.</td>
</tr>
<tr>
<td><strong>Tagging</strong></td>
<td>Tags (adding a symbol to the TAG field) in v7 were added to the main data files. Thus, on networks, one person’s tags could interfere with those of another. In v8, while, as before, tags appear in the main tables, they are held in a user specific tag table. Thus, all tags and tag functions are now specific to each user. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#tagging">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#tagging</a></td>
</tr>
<tr>
<td><strong>Excel</strong></td>
<td>V8 has much improved connectivity with Excel. You can open Excelxlsx files more easily and transfer the data into BRAHMS. You can also save data more easily to xlsx files. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#importing">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#importing</a> <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#exporting">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#exporting</a></td>
</tr>
<tr>
<td><strong>Memo fields</strong></td>
<td>The concept of memo does not exist and you will not see ‘memo’ in the data grids. However, the text fields that replace them are effectively the same in that they store any length text strings.</td>
</tr>
<tr>
<td><strong>Opening and docking multiple tables</strong></td>
<td>Unlike v7, you can open as many tables as you need at the same time. These tables can be docked in different ways to optimise viewing. You can use multiple monitors to display tables, forms, images, maps and other windows. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#multiple">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#multiple</a></td>
</tr>
<tr>
<td><strong>Dynamic web links</strong></td>
<td>You can now open multiple external website links at the same time and these will auto update as you scroll through your data grid. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#weblinks">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#weblinks</a></td>
</tr>
<tr>
<td><strong>Mapping</strong></td>
<td>In addition to the v7 mapping options, v8 includes in-built ArcGIS API mapping to display your data. Map points and grid records are connected allowing you to locate the current record or map point, very handy for finding map errors. <a href="https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#mapping">https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#mapping</a></td>
</tr>
<tr>
<td><strong>RDE</strong></td>
<td>The concept of Rapid Data Entry (RDE) remains. RDE files continue as portable and flexible flat files for data transfers and capture. RDE file structures are now identical to the tables they represent; you can hide and reorganise fields but not remove them; each record has a GUID providing 100% connectivity after import to the main database; RDE data can be edited and used to update data that have already been imported.</td>
</tr>
<tr>
<td><strong>BRAHMS online</strong></td>
<td>Website design and data uploading are more fully integrated in v8. For example, you can see your web page updates online as you edit the HTML.</td>
</tr>
</tbody>
</table>