Documentation for Version 8

Updated November 2026

For installation and upgrading: https://herbaria.plants.ox.ac.uk/bol/brahms/support/installv8

Training guide: https://herbaria.plants.ox.ac.uk/bol/content/software/v8/Getting_Started_BRAHMS.pdf

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

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

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ANNEX 1. UPGRADING BRAHMS V7 TO V8 282

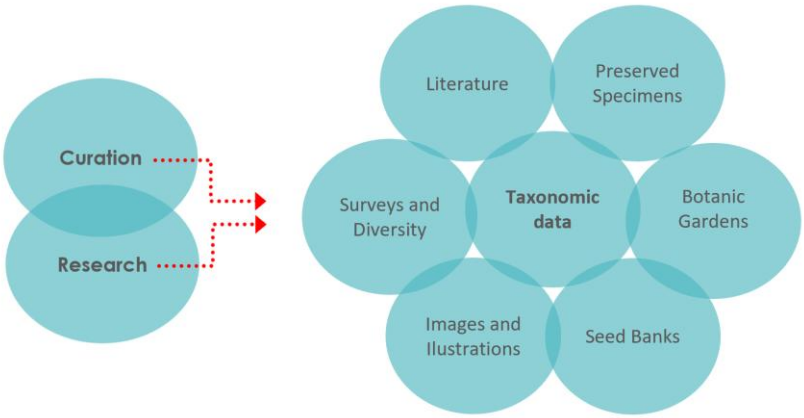
ANNEX 2. KEY DIFFERENCES BETWEEN BRAHMS V7 AND V8 283

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 researches 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 - OXFORD UNIVERSITY INNOVATION



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.

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

https://herbaria.plants.ox.ac.uk/bol/brahms/software/trainingvideos

Some acronyms and other terms used in BRAHMS

ArcGIS API	Internal mapper used in BRAHMS.
BGCI	Botanic Garden Conservation International.
BOL	BRAHMS Online.
BRAHMS	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.
Calculated fields	Fields that are not automatically updated – they are updated using the Recalculate function.
Collection event	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.
Custom field	A non-standard data field added to BRAHMS (known as link fields in v7).
Data Connection	A data connection is a link from the BRAHMS software to a data store. A data store may have one to many databases.
Database project	A specific database (= project) in a data store.
Edit History	The history of edits made to the database. This is called Track Changes in v7.
Gazetteer	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.
Lookup List	The central lookup dictionary as found on Management > Lookup Lists.

Merge records	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.
Merge values	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.
Query or Filter	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.).
RDE	Rapid Data Entry. RDE files are external to BRAHMS, used for efficient data capture. Refer to the Rapid Data Entry section.
Specimen	A physical object of any category, derived from a collection event.
Tag	A single character mark (default=*) in the TAG field. This field is found in all tables.
Tag groups	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'.
Transaction	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.

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 will vary depending on your resources, the amount of data to manage and your longer-term objectives. 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 often 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 (16GB or ideally more), there are no special requirements other than that the .NET version is sufficiently up to date.

For institutions with large collections, perhaps many millions and many simultaneous users, the actual database will be stored on a server in PostgreSQL or MSSQL Server. It is important that the server is well resourced with sufficient disk space, adequate RAM and a good processor. If you try to run a large database on an inadequately resourced server, performance, under most circumstances, will be poor. Performance is broadly related to how well resourced your infrastructure is. An under-resourced server and/or client workstation leads to poorer performance.

As an example, the BRAHMS server used in Oxford has 256 GB RAM. BRAHMS rarely uses more than 50% of this memory but nevertheless, where the server is used for multiple applications, it is comforting to have some extra RAM. RAM is helpful as some categories of task are cached. Having plenty of RAM makes querying more efficient. You do not need 256GB - but try to aim high.

Disk space? These days, disk space is measured in TB. Make sure your server has adequate space bearing in mind that stores such as PostgreSQL or MSSQL Server tend to reserve empty space for database expansion. A BRAHMS database with *ca.* 10 million specimen records (including all the related tables) will use *ca.* 100GB.

Images? It's easy to calculate the space required for images. For example, 1 million images, each 5MB in size, would require 5TB storage. Images may be stored on different servers. They can be referenced in BRAHMS as physical files or as URL references (e.g. to a media library).

BRAHMS itself will be installed on a shared drive that all users can access or on individual client workstations. You may also use remote server log in by users located on different sites. On larger networks, the set up 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 is stored (possibly also the BRAHMS software), the role of client workstations should not be underestimated. When you log into the BRAHMS software, the system uses the resources of local workstations. Thus, even if your server is extremely well resourced, under-resourced workstations may not perform well.

In summary, cutting corners on hardware set up is something of a false economy when it comes to established 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.

We can provide further tailored advice on hardware on a project by project basis.

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.

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, DNA 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 and updates

Licensing

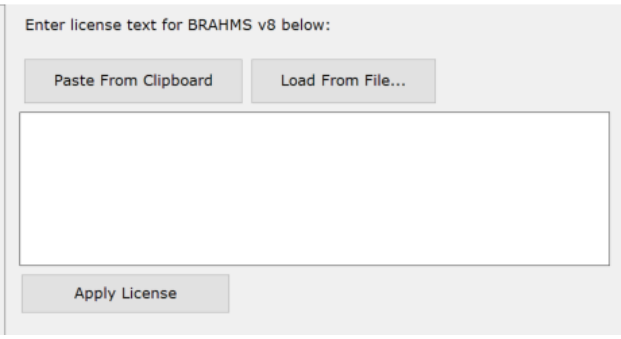
To open BRAHMS, you will need either an evaluation key allowing you to test the system for 60 days or a full licence key. Both are obtained from Oxford University Innovation (OUI).

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

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

lgBAN8JkR7HNUBBQBmAE5hbWU9U29sYW51bSBQcm9qZWN0OiBSb3lhbCBCb3RhmIjIEdhcmRlbnMgRWRpbmJ1cmdoICgTmF0dXJhbCBIaXN0b3J5IE11c2V1bSNQdXJjaGFzZURhdGU9MDkvM123MjAxOQEPg4hL3jcIbjaoucSgmBN7OIiM2yDmE637gvJV/BArl5/UK0hY4ph84fKWap9q/XRG8inHEyTGa8w2vRoOvfGm=

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.



Prerequisites and .NET

BRAHMS operates under Windows or on Macs with Parallels, Virtual Box, Boot Camp or equivalent.

As of **v 2026.4.1 (October 2026)**, BRAHMS requires that you have **.NET 10** available on your PC.

.NET 10 (formerly .NET Core / modern .NET) is not tied to the Windows version and can be installed separately alongside other .NET versions. To check if you need to install .NET 10 on your PC, you can run the Command Prompt "dotnet --version", it will display 10.0.xxx in the response if .NET 10 is installed. If it is missing, .NET 10 is easily installed using options on **https://dotnet.microsoft.com/en-us/download/dotnet/10.0**.

For earlier versions of BRAHMS (pre October 2026) BRAHMS is compiled using .Net 4.8.1. This is the current .Net 'Framework' version which will be available on Windows 10 (and later) PC's. For anyone unable to use the 4.8.1 compiled version a .Net 4.7.2 version is available for download.

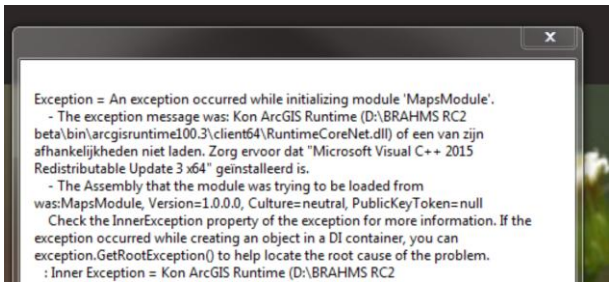
As further discussed below, ideally your workstation will have 8GB of RAM or more. RAM is used by database applications for most operations.

Other issues you may encounter

WebView2 installer

If you have trouble accessing any web related functions in BRAHMS and/or have error messages in your log file that refer to 'Couldn't find a compatible Webview2 Runtime installation to host WebViews. Source :Microsoft.Web.WebView2.Core' (or similar to this), this usually implies that your PC does not have the required Microsoft webview2 components. In this case, please visit https://go.microsoft.com/fwlink/p/?LinkId=2124703 – this will download a exe runtime file MicrosoftEdgeWebview2Setup.exe which you can quicky install.

C++ redistributable



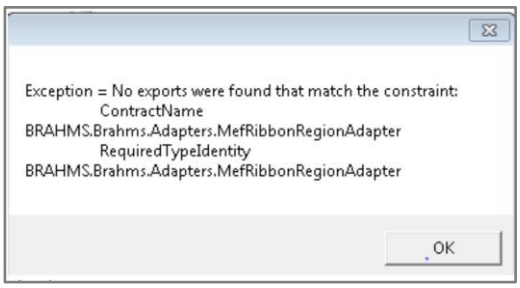
If you get an error similar to the above, you need to download the Microsoft Visual C++ redistributable as on:

https://aka.ms/vs/17/release/vc_redist.x64.exe for a 64 bit system

https://aka.ms/vs/17/release/vc_redist.x86.exe for a 32 bit system

(This will work for 2015, 2017, 2019, and 2022 versions)

Blocked DLL files



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 above. Alternatively, your system menu may simply not display correctly – typically showing only **System.** 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 or another utility. Another possible explanation is your security system (e.g. anti-virus) requires you to include brahms.exe as a trusted exception.

Software folder location

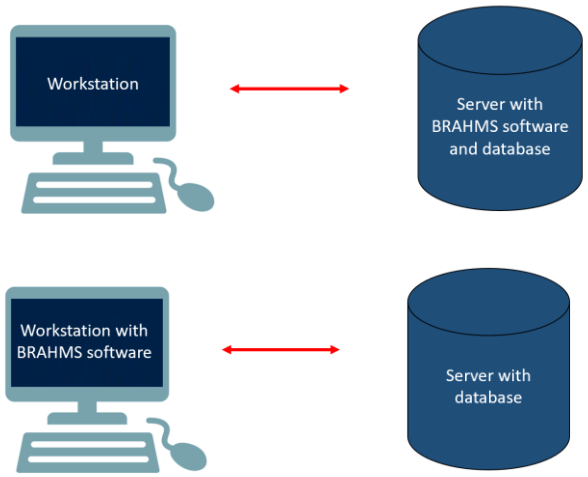
The BRAHMS software folder can be located on a drive that all users have access to, either through a share or via internet access. Alternatively, it can be installed on each local workstation/PC where it will be used. Otherwise, there are no restrictions of the location and/or name of the installation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



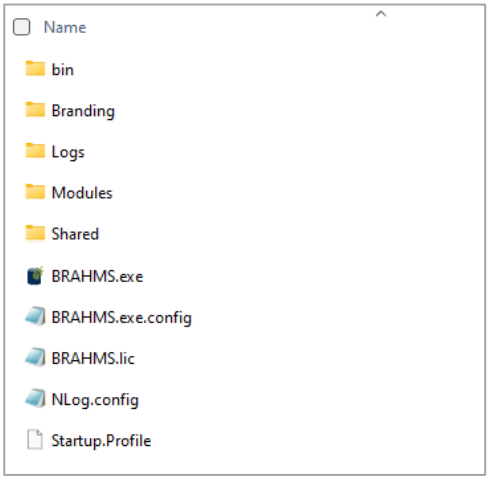
Whether the software is on the server (above right) or on the workstation (above left), both will benefit from being well-resourced.

Installing v8

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

Opening your software zip: Downloaded zips that contain certain types of software files are blocked for security reasons. If you right-click on the brahms.zip file and choose **Properties > Security**, you can see if it is blocked. If so, select the Unblock tick box. Once unblocked, you can open the zip using any extraction software. If you have any issues running BRAHMS after opening the software (typically you might only see the System menu), we recommend opening the software zip with 7z rather than Windows extraction. 7z is free software and can be downloaded from https://www.7-zip.org/download.html You can check the zip file Properties > Security tab to make sure it is not blocked.





After opening the install zip, you will have a software folder similar to that shown here. This folder also has a BRAHMS licence file. Evaluation versions do not have this licence file.

Files/Folders	Notes
bin	Core application DLL and ArcGIS runtime files.
Branding	Branding banner image and other branding items as available.
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.

Software and database updates

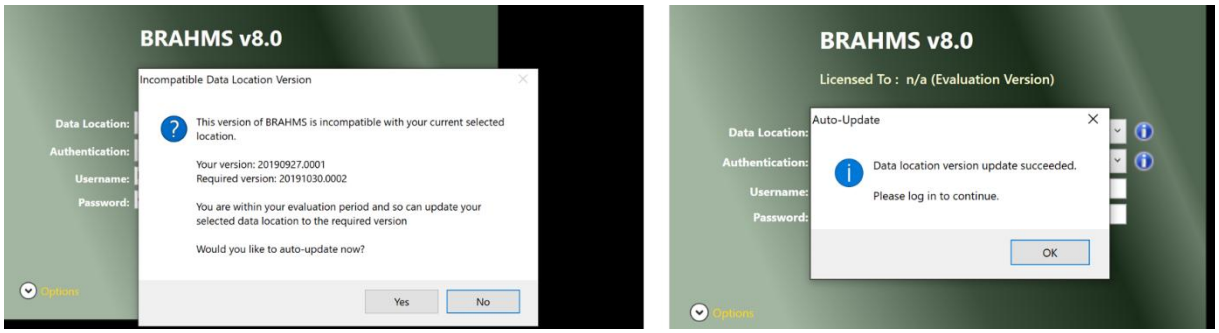
The upgrading process

Software updates are issued periodically. 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 and a summary of the update content is posted on https://herbaria.plants.ox.ac.uk/bol/brahms/software/revisions

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.

For further details on updates, refer to:
https://herbaria.plants.ox.ac.uk/bol/content/software/v8/BRAHMS_upgrading.pdf

BRAHMS server access requirements for updates

If it is necessary to update the structure of your database or your RDE files, the necessary scripts to run, as determined by your current database versioning ID and that of the newly installed one, are located by BRAHMS on the BRAHMS server. You need to be online and have access to these scripts - otherwise you will receive an upgrade failure message.

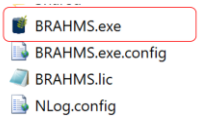
Normally, access to https://herbaria.plants.ox.ac.uk should be sufficient. This is just a web server where the BRAHMS *.zip downloads are located and you should permit access to. If more specificity is required then https://herbaria.plants.ox.ac.uk/bol can be used. If you need to restrict it further, you would need to permit any .zip file download from https://herbaria.plants.ox.ac.uk/bol/content/software/vu/updates/. Please note that this URL is not directly viewable as browsing that location is not permitted and thus it would return a 'forbidden' status unless a valid zip file name is appended for download).

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.

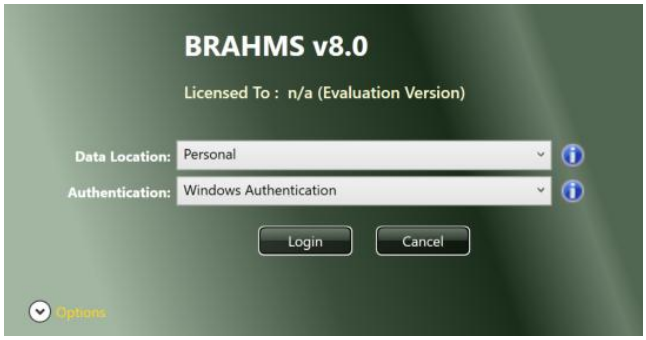
Note: if you have file extension hidden on your PC, the correct file to run in the one with blue database icon. There is another file called brahms.exe.config which is not the application file.



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 work stations.

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.



Logging in using BRAHMS Authentication. You can use Show to reveal the password.

First log in and database ownership

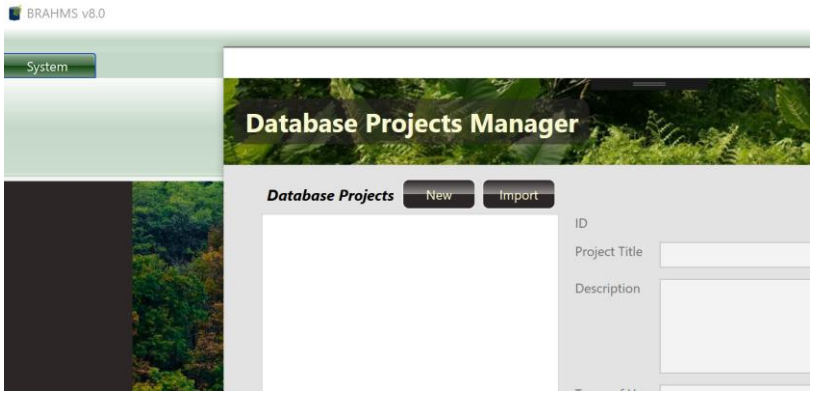
The first log in to a newly created database assigns ownership to that database. Thus, if you log in using Windows Authentication, your windows account will, initially, be the only way to open the database. Adding or editing different users is discussed in the users and permissions section.

The Database Projects Manager form

As initially, the default personal data store is empty (= no database projects), the first log in will auto-open the **Database Projects Manager** screen with options **New** and **Import**.

The **Import** option is used to import data from a selected XML folder. This may be XML data exported from an earlier version of BRAHMS (*e.g.* v7) or from another BRAHMS database. The **New** option is used to create a new and empty database project in your newly created brahms.db SQLite store.

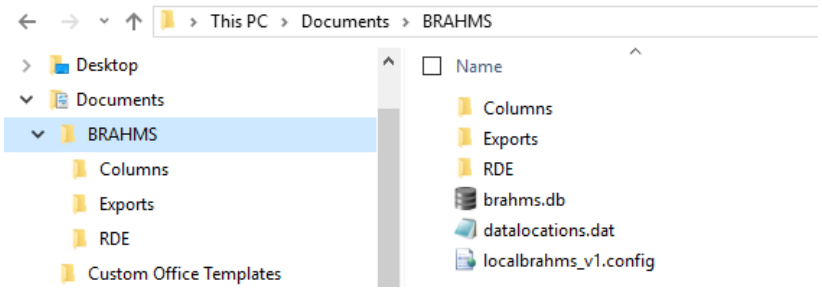
Unless you have data in an XML folder to import, select **New**, add a suitable Project Title and select **Save** followed by **Load Project**. This will then give you full access to all menu options including **System > Manage Data Connections** which enables you to set up data connections as discussed in a further section in this manual.



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, by default, a folder called BRAHMS is created in your Documents folder. This is used for the location of the empty brahms.db data store and some setup files. As discussed below, a different folder can be assigned.



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

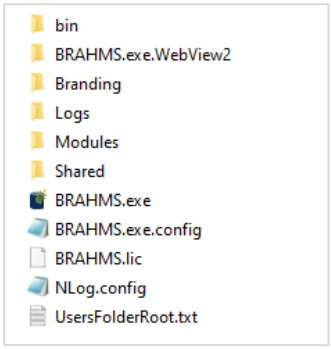
File/Folder	Notes
brahms.db	The default SQLite datastore, initially empty.

datalocations.dat	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.
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. Dimorthanthera_taxonomy.rde Field trip 2018_taxonomy.rde The genus Inga_taxonomy.rde Each .rde file is a self-contained SQLite database with the RDE file metadata, the data itself, image links and edit history.

Choosing a different folder to Documents/BRAHMS

On some networks, it may be preferable to choose a different folder to Documents\BRAHMS as the default working location for storing those files normally stored in Documents/BRAHMS. For example, in some cases, especially where roaming profiles are used, the Documents folder may cause problems with file access if the path has hidden components.

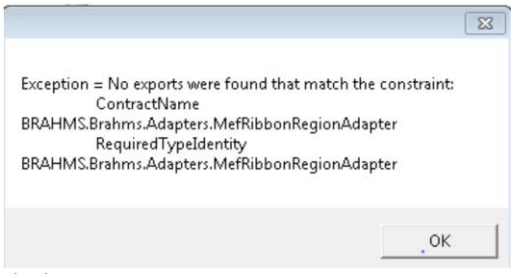
In these cases and/or you prefer not to use your Documents folder, you can copy a small txt file to the BRAHMS software folder which includes a valid path name. The file must be called *UsersFolderRoot.txt.*

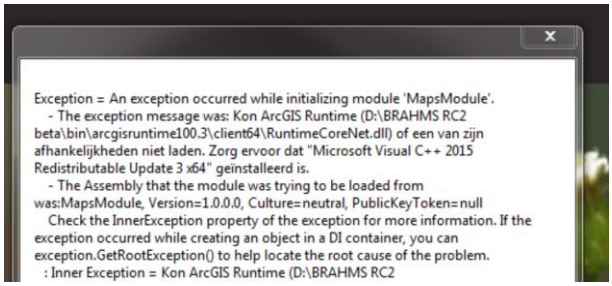


BRAHMS software folder with a UsersFolderRoot.txt file in place.

An example entry is C:\BRAHMSROOTFOLDER. In this case the folder would be created (if it is new) on the user's local C drive. The path could also refer to shared network drive which may use drive letter or UNC file path. In this case, all users who are using the same BRAHMS software client will have a subfolder created within selected network folder. The subfolder names will reflect the user identity.

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 or another utility. Another possible explanation is your security system (e.g. anti-virus) requires you to include brahms.exe as a trusted exception.

If the error is similar to the right-side screen above, you need to download the Microsoft Visual c++ redistributable as on:

https://aka.ms/vs/17/release/vc_redist.x64.exe for a 64 bit system

https://aka.ms/vs/17/release/vc_redist.x86.exe for a 32 bit system

(This will work for 2015, 2017, 2019, and 2022 versions)

Data stores and databases

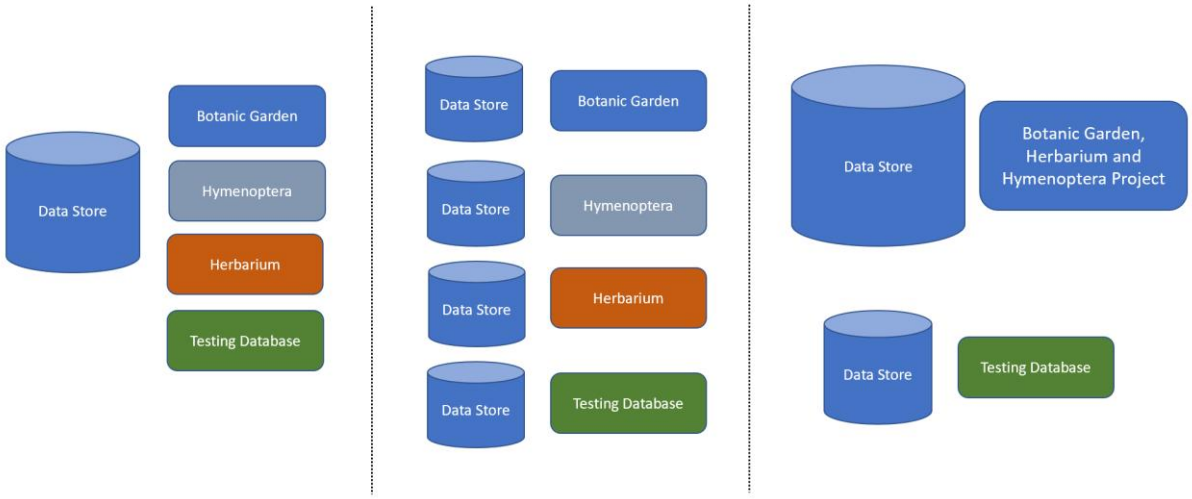
The difference between data stores and database projects

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.



A single data store may include many separate database projects (left). Alternatively, projects may opt to create a separate data store instance for each database project (centre). For improved integration, related data can be combined in a single database project in a single store (right).

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 RDE files.

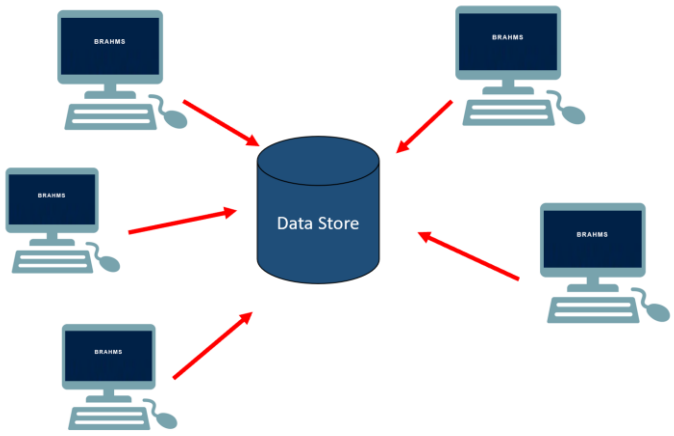
MSSQL Server and PostgreSQL need an extra step

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, PostgreSQL and MSSQL Server Express are free and can be easily installed by yourself on your local PC.

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. The procedures to do this are discussed in this guide.

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.



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.

Data Store	Licensing	Notes
SQLite	Free	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 https://sqlite.org/index.html.
MSSQL Server Express	Free	2008 R2 or later see e.g. https://www.microsoft.com/en-gb/sql-server/sql-server-downloads will function but not strongly recommended for large (tables with > 500,000 records), multiple user databases.
MSSQL Server	Licence required	2008 R2 or later see e.g. https://www.microsoft.com/en-gb/sql-server/sql-server-downloads – scalable to any size.
PostgreSQL	Free	9.3 or later see e.g. https://www.postgresql.org/ - scalable to any size.

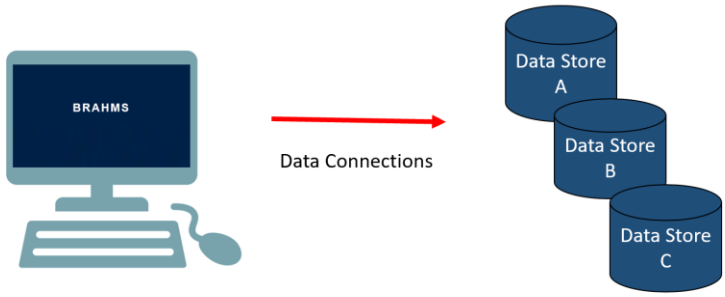
Current options for data storage in BRAHMS v8.

Data connections

If you have problems connecting to a database, refer to the Troubleshooting section at the end of this section.

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.

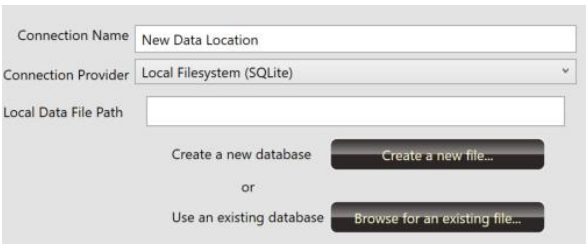
Data Connections, Servers and IT help

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. 'sampledatabase.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.

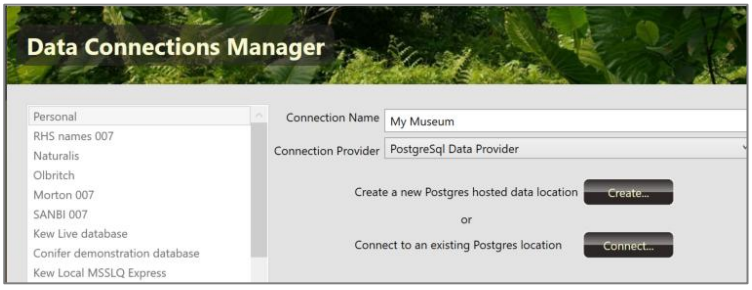
Creating a PostgreSQL connection and database

Creating a PostgreSQL database and the connection from BRAHMS to it involves a few steps. The way PostgreSQL manages the security for database connections is different to MSSQL Server.

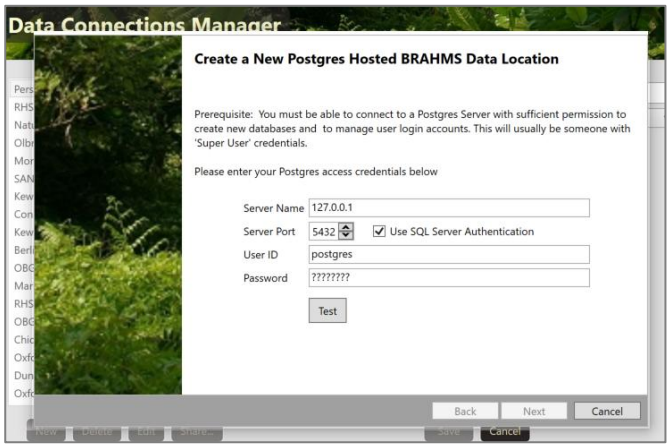
Assuming you have installed PostgreSQL, you should be able to do everything else from within BRAHMS. Please follow the steps carefully. If you need to install PostgreSQL on your server or on your local PC, see https://www.postgresql.org/download/ or similar.

The task here is create a new database and the required database connection to your PostgreSQL server, wherever this may be.

- For the following steps, you can be logged in to any BRAHMS data connection including the SQLite personal database.
- As a first step, select **System > Manage Data Connections…** then **New**.
- Choose a **Connection Name**. This name will appear eventually in your BRAHMS login form as a data connection option.
- Choose the PostgreSQL Data Provider as the **Connection Provider**.
- Then select **Create…** to initiate the process.



The first steps are shown above.



On the **Create** form, the settings will be similar to the above. The purpose of this step is to create a PostgreSQL database – not a BRAHMS database. Confusing? It is a bit - but PostgreSQL needs to have an underlying database created before we can go on to the next step. If you can pass this security test, you are well on the way to creating the new database.

The **Server Name** here is the standard representation of the IP address of 'localhost' on your local PC. If you are creating a connection on another server, the server name entry will be the Domain Name or IP address of the server that is hosting PostgreSQL.

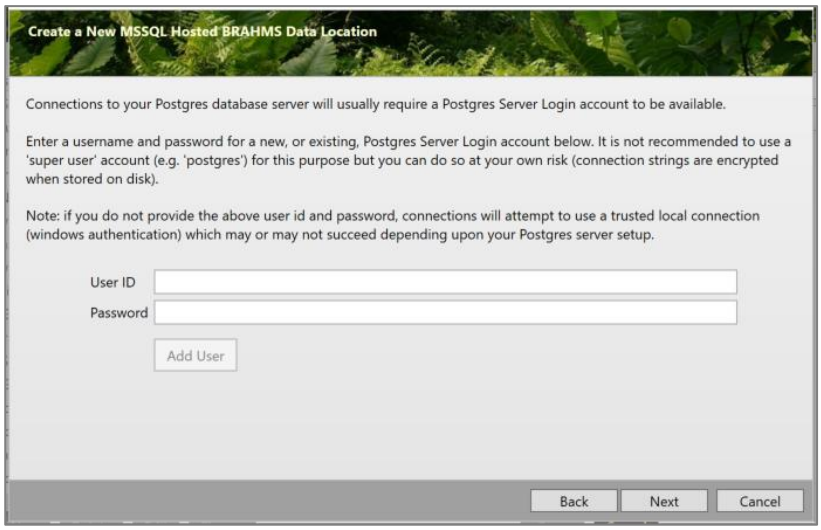
The **Server Port** as shown here is the standard port used to connect to a PostgreSQL server. Note that while this value is configurable by the administrator of the server, it is unlikely to have been changed.

The **User ID and Password** entered above will be the credentials of a user who has permission to create a PostgreSQL database. Normally, this will be so called PostgreSQL 'superuser'. The superuser will have been established when PostgreSQL was installed. This user name and password is only needed to create a new connection. It is not otherwise used by BRAHMS.

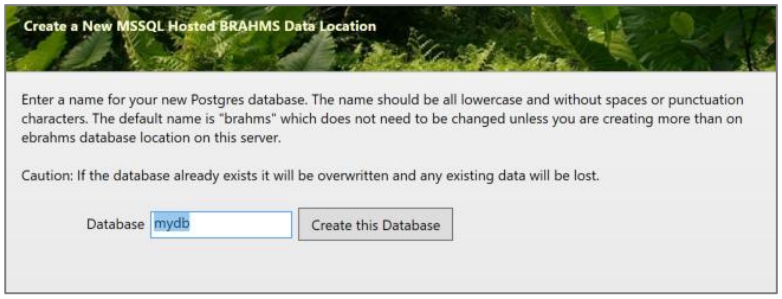
Note: it seems that if a user with permission to do so (e.g. the superuser) uses PostgreSQL admin tools to alter table structures, any other user credentials may be re-set.

Use the **Test** option provided to check your connection works. Assuming it does:

The next screen asks for another User ID/password – this is a bit confusing. The user ID and Password added here should be different to the superuser for security reasons. You can create new ones if necessary. This user ID/password will be added as a Login/Group Role 'account' on the PostgreSQL server and these credentials are then used to connect to the server and to create the actual BRAHMS database structure in a next step.



*Assuming you have permission to do so, you can select an existing or add a new user ID /password here. The password you add above must have a minimum of 6 alphanumeric characters to enable **Add User**.*



When entering a Database name, you must keep it lowercase and with no spaces.

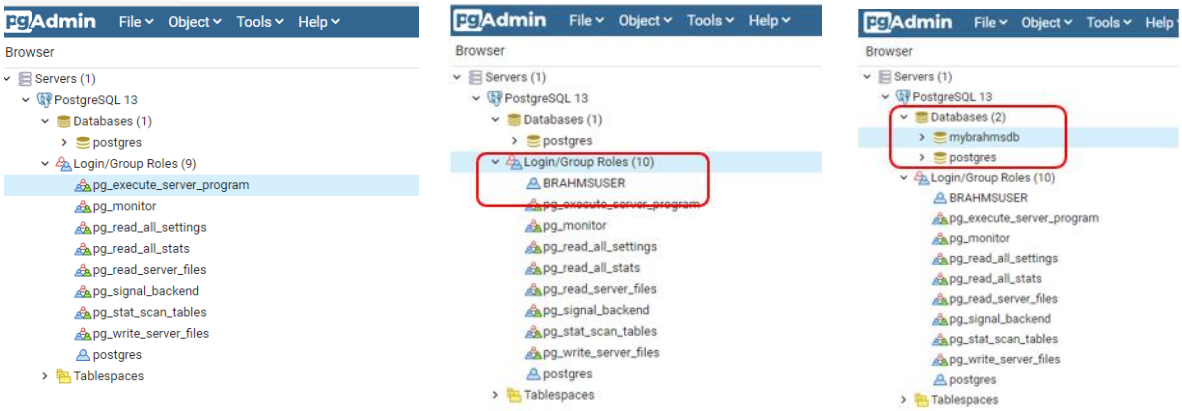
In the next stage as shown above, choose a lowercase name for the PostgreSQL datastore – do not include spaces. This is not the name of the actual BRAHMS database – rather just a server store name. Once you select **Create this Database**, BRAHMS will proceed to set up an empty BRAHMS database/store inside PostgreSQL. This store will have all the BRAHMS tables, views, indexes, *etc.*

If this step is a success, you can then **Finish** and move to the final step.

Use **System > Sign Out** and then, on the BRAHMS login screen, choose your new connection name as added above in step 1.

When you first log in to BRAHMS, you can use Windows or BRAHMS Authentication. If using BRAHMS Authentication, do not forget the username/password you select as this will be added as the default log in credential. You can of course then proceed to add further users and passwords.

After this stage, you can use the BRAHMS options to import data from XML or to create one or more new empty database projects in the new PostgreSQL datastore you have just created. If creating a new database project, this is where you add the database name e.g. "Conifers of the World".



The above images show the steps as they build up in the PostgreSQL manager. The first image is before we start. The middle image shows the addition of a new account name here called 'BRAHMSUSER'. The final image is after the creation of a new database (perhaps better called 'data store' here called 'mybrahmsdb'. Note: you don't need to have access to the manager to create a database.

Creating a MSSQL Server connection and database

The processes to create a connection to an MSSQL Server database are broadly similar to those for PostgreSQL and can be done from the Data Connections option.

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.

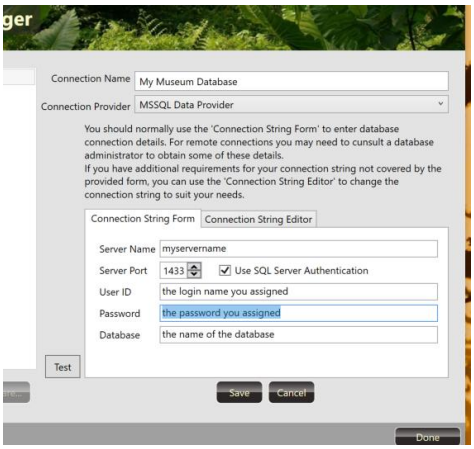
If you are using the licenced full version of MSSQL Server, you will probably be connecting to this on another server and in this case, will have to check that you either have the access to create a new store or that this is done for you and you are able to establish the connection.

- For the following steps, you can be logged in to any BRAHMS data connection including the SQLite personal database.
- As a first step, select **System > Manage Data Connections…** then **New**.
- Choose a **Connection Name**. This name will appear eventually in your BRAHMS login form as a data connection option.
- Choose the MSSQL Data Provider as the **Connection Provider**.
- Then select **Create…** to initiate the process.



Choose a connection name and set the provider to MSSQL

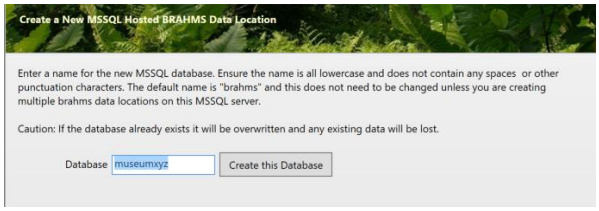




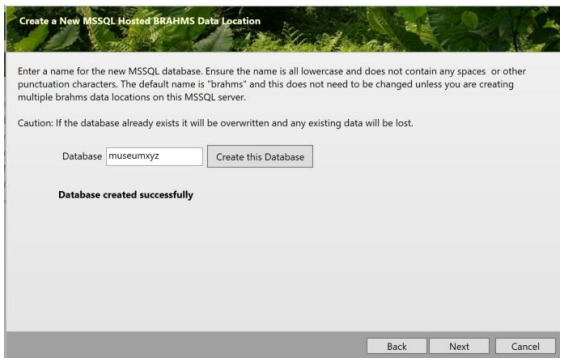
Depending on how you installed MS SQL Server, you may be able to use Windows Authentication or you may choose to use MSSQL Server authentication to access the server and create a new database. For example, if you installed SQL Express on your own PC, and you are not connecting to this from another PC/location or over the network – then windows authentication can be used. In most cases SQL Server authentication will be the best choice.

The test should lead to a 'Test Connection Succeeded' message. Note the format used to refer to your local express server.

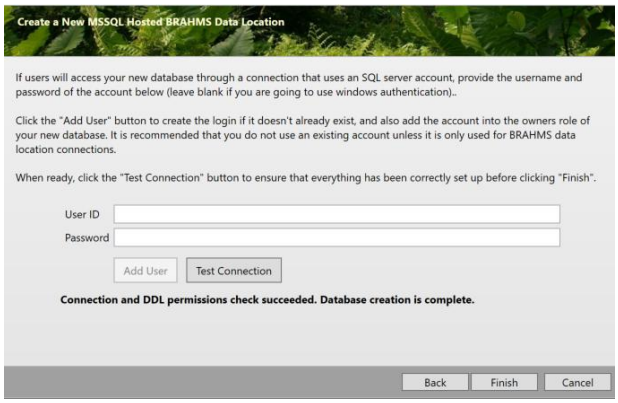
To create a data store, the User ID/password usually are the credentials used by the DBA (Database Administrator) with permissions to create a database and user accounts on the server.



*Provide a lowercase, no spaces name for the database and then **Create this database***

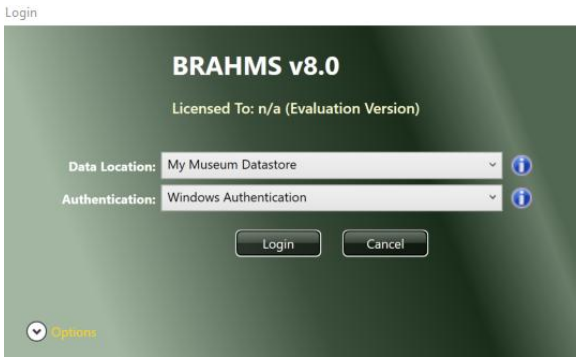


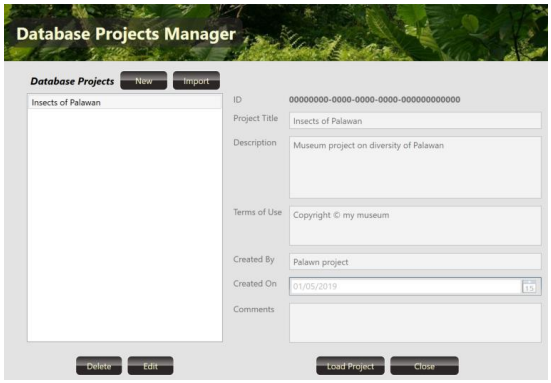
Successfully created



*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.



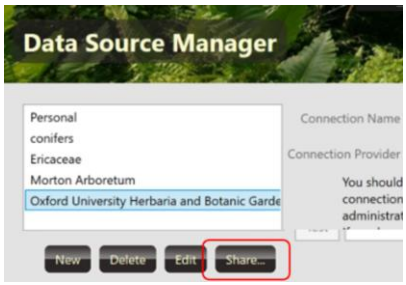


*On the first login, the Project Manager form will open. Choose **New** and enter a description of the project as prompted. Once completed, you can choose **Load Project** to open the new project in the newly created data connection.*

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 owner's role of the BRAHMS database. Once this is completed, you can setup and test a data connection from BRAHMS.

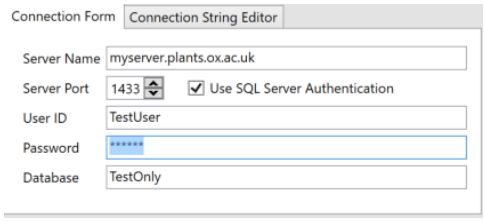
Sharing data connections

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. Shared files are named with the data connection title e.g. 'Oxford Database.dat'.



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.



An example server name for a connection which would allow someone with appropriate access to log in from any location.

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.

Troubleshooting

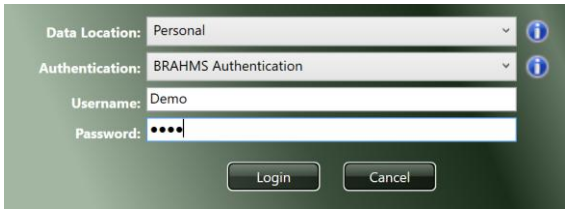
If you have installed the BRAHMS software on your PC and can't find a database to open, this means that the local 'data connections' file on your PC has no data connections or there is a connection but it is not available. If you had a successful connection before, this may have been from another copy of BRAHMS on a different PC with its own data connection setup. Data connection details are stored on your PC and are not stored in the database or software. Note that on networks, data connections can be shared by adding the connection to shared folder in your BRAHMS application.

The default Data Connection for any BRAHMS installation is the one called 'Personal' on the login screen. Unless this has been somehow edited, it will point to the file brahms.db located in your Documents\BRAHMS folder. This connection does not require any special installation – it comes with BRAHMS.

What is brahms.db? This is a complete BRAHMS database structure template in SQLite format. The brahms.db file delivered with BRAHMS is empty – it has no actual databases in it – but they can be created/imported.

If there are any problems with logging to personal, please the steps below. Unless you have been provided with another database, your best bet for initial testing, is to connect to the demo conifer database. Then you at least have a system to practice on.

- Log out of BRAHMS, go to your Documents\BRAHMS folder and delete the single file brahms.db.
- From https://herbaria.plants.ox.ac.uk/bol/brahms/support/conifers - download the demo database for BRAHMS 8 and store this zip in your Documents\BRAHMS folder. This is the conifer demo database.
- Open this zip file to your Documents\BRAHMS folder. This will create a brahms.db file which contains the conifer database. You can delete the zip file.
- Now log into to BRAHMS again – choosing the data location *Personal*.
- Choose *BRAHMS Authentication* and use the user name **Demo** and password **demo** (in lowercase). These are the default log in details for the conifer demo database.



NB. If the log in results in the prompt: '*Would you like to auto-update now?*', simply say Yes and proceed to log in again. This prompt would only occur if your software is more updated than the conifer demo as available on the website.

The database manager

Introduction

The database manager is accessed by selecting **System > Manage Database projects.** While the Connections Manager manages connections between the BRAHMS client and your data store (e.g. an instance of MSSQL Server or PostgreSQL, the Database Manager manages the databases in the current data store. A given data store may have one or several databases - in most case, one.

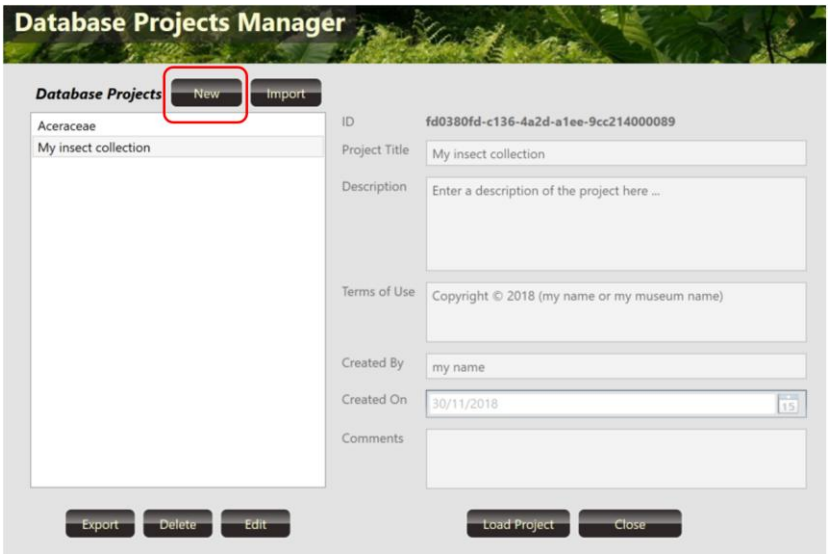
This manager provides tools to:

- Create, edit and delete database projects from the current data store
- Import a database from a BRAHMS XML folder
- Export data to a BRAHMS XML folder

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 Title and a few details as requested.



Creating a new project

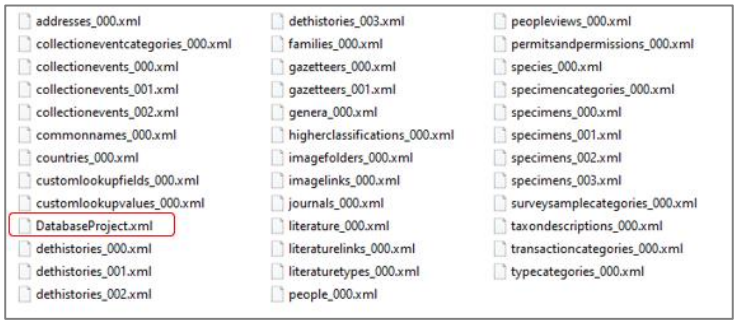
If you create more than one database in the same store, when you next log in to this connection, you'll be asked to choose which database to load.

Import a database from XML

The import option imports data in BRAHMS XML format to a new, empty data store of your choice. An example is the XML folder provided for the conifer demo database or any database exported from BRAHMS v7. The conifer XML can be downloaded from: https://herbaria.plants.ox.ac.uk/bol/brahms/support/conifers. These data can be imported into a new SQLite, PostgreSQL or MSSQL Server database.

You cannot use this option to add data to an existing database.

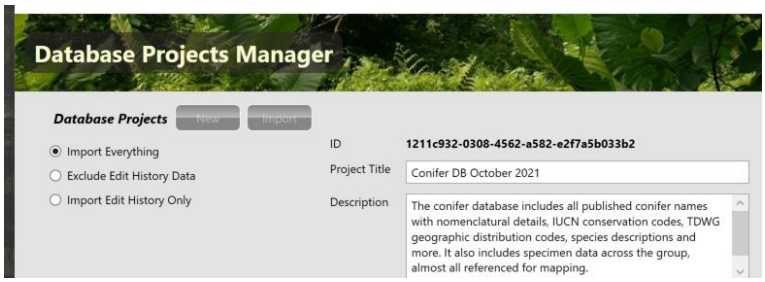
The XML data is always provided as a series of files in a single folder. One of the files is named *DatabaseProject.xml*, When you select **Import**, as show below, you will be asked to locate this file.



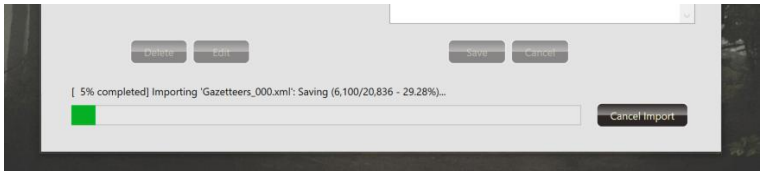
Sample BRAHMS data transfer XML folder



Choose Import to pull in data from an XML folder. This option can only be used in a newly created, empty database.



With the demo conifer database, you can choose Import Everything – in fact the edit history for this database is not provided in the XML folder.



The data are imported with progress shown on the status bar.

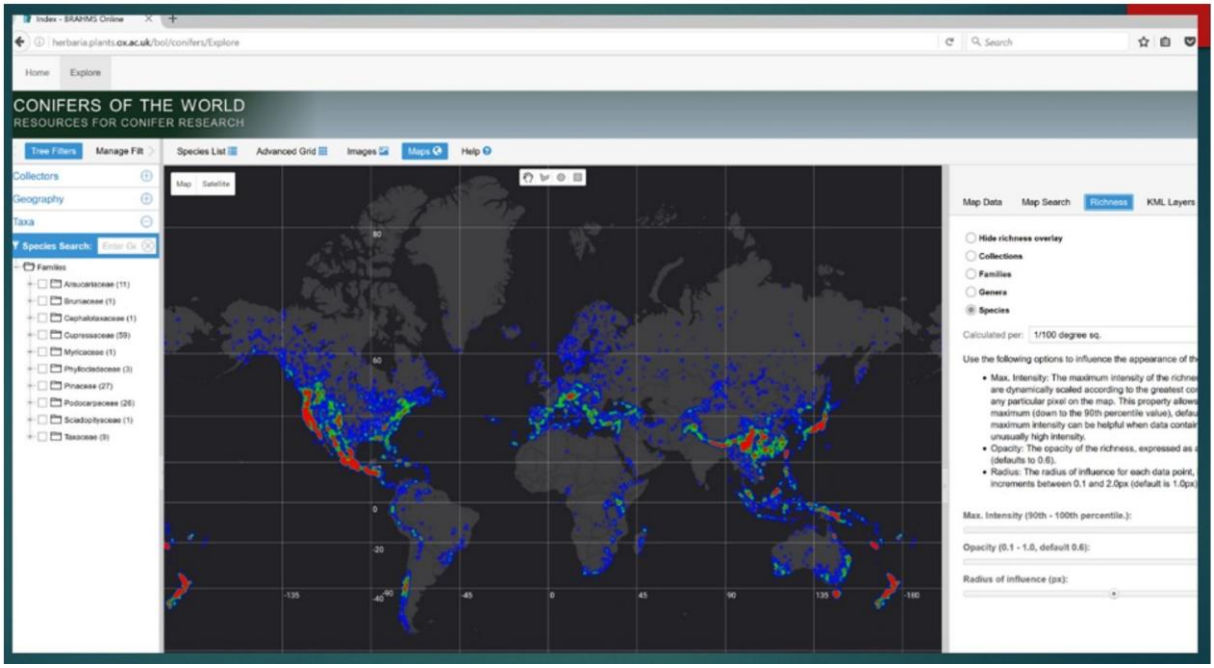
Export an entire database to XML

The **Export** option on the Database Manager form is used to export all data from a selected database. This option does the reverse of the **Import tool** described above. It creates a folder of XML files is a designated folder. Refer to the section on Exporting databases.

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.

The database has been used as the basis for: A taxonomic monograph on Pinus for Latin America (Farjon, A. & Styles, B. T., 1997. Flora Neotropica Monograph 75, The New York Botanical Garden; A World Checklist And Bibliography of Conifers, Aljos Farjon, 1998; A Monograph of Cupressaceae and Sciadopitys, Aljos Farjon, 2005; A Handbook of the World's Conifers. Publication: 2010; An Atlas of the World's Conifers, an Analysis of their Distribution, Biogeography, Diversity and Conservation Status, Aljos Farjon and Denis Filer: 2013.

Importing the demo database as XML

Refer to the instructions provided in the section above on Import a database from XML.

Connecting to the SQLite database

Rather than import the XML, you can also download a ready-made SQLite version of the same database.

Download and open zip

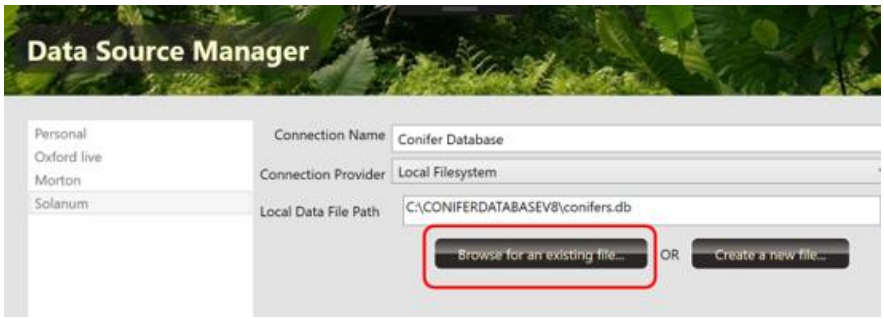
- Download the SQLite file from https://herbaria.plants.ox.ac.uk/bol/brahms/support/conifers
- Open the zip to create the file brahms.db
- Copy the file to your Documents\BRAHMS folder overwriting the default brahms.db file
- Log into Personal using the credentials:

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.



Browse to locate the downloaded conifer.db sample database - then save.

Managing user accounts and permissions

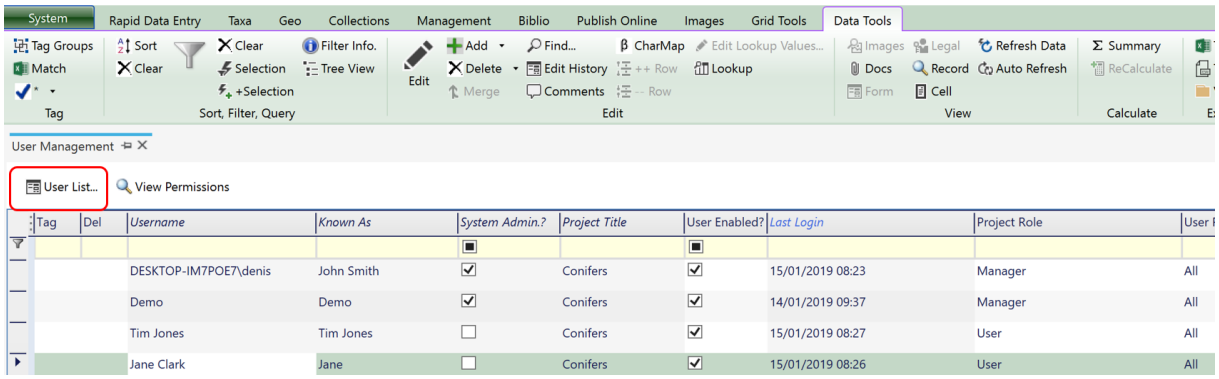
Introduction

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.



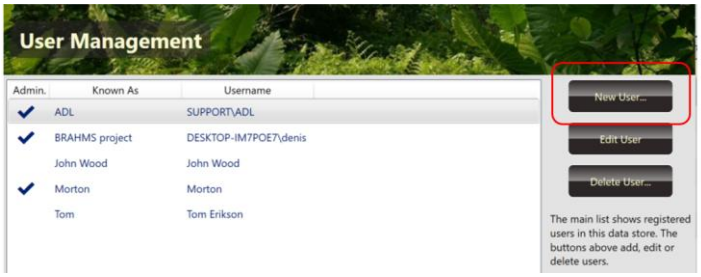
The database members table lists all users with database membership(s).. There is one entry per user per database project. Thus, if the data store includes 2 database projects and a user has access to both, the user will be listed twice in this list.

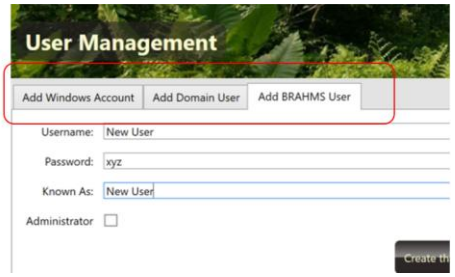
As well as providing the user name, this list indicates whether they are a system administrator, and their project role as manager or user. In **Edit** mode, the Project Role can be changed. The names and other fields in this grid can be searched and filtered as in any other data grid. Passwords are 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.



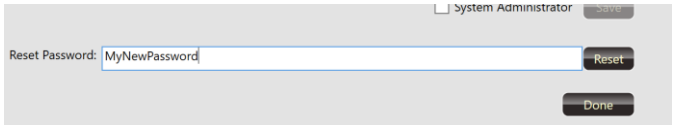


To add new user account, select the **New user…** option. The tab *Add BRAHMS User* asks you to add in the name details and whether they are Admin or not. The other options, *Add Windows account* and *Add Domain User* do not require that you add a user name/password as this information is known by the 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.

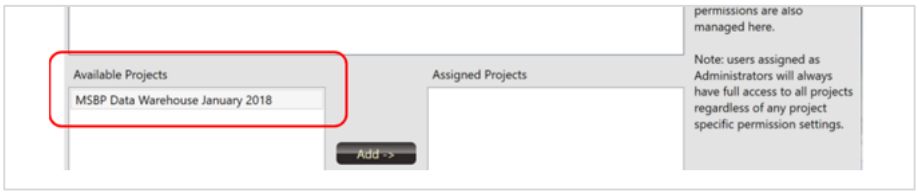


Passwords can be reset by the system administrator.

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.*

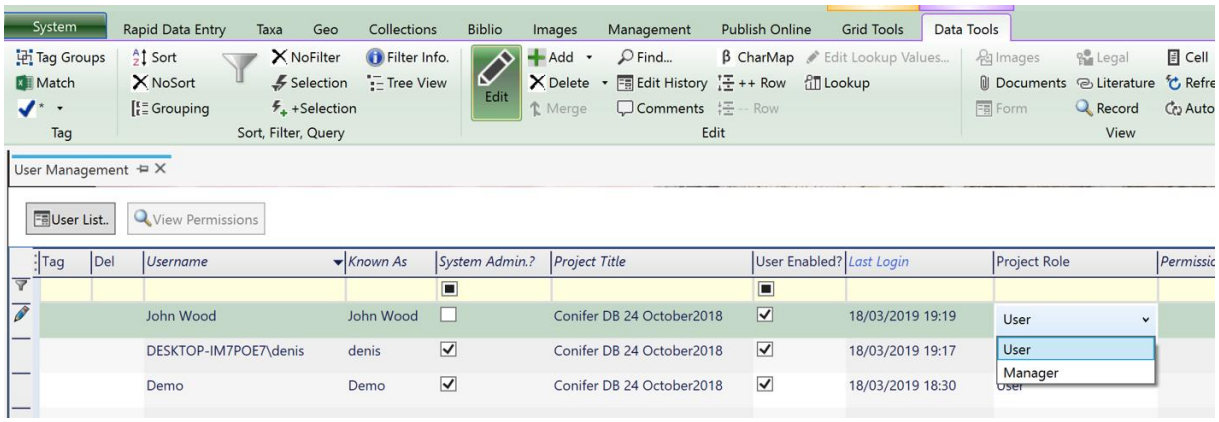
Thus, the task of the System Administrator (or in this case also the Database Manager), once users have been added to the user list, is to ensure they are given access to the appropriate database project(s).

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 work station 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

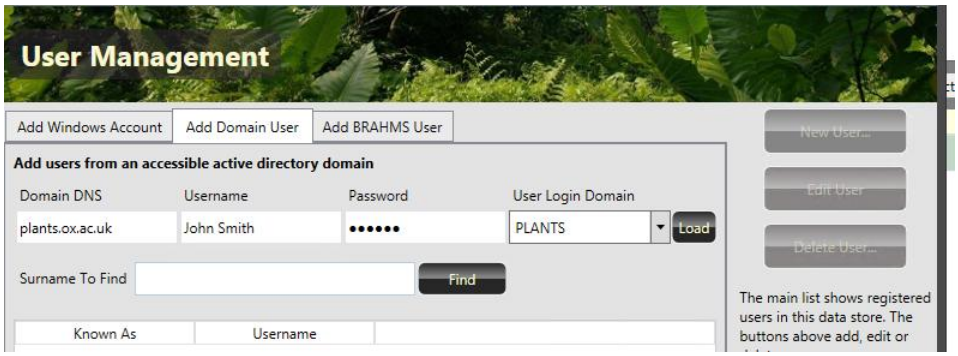
This is windows authentication on the user's local workstation. No user name or password needed when logging in using Windows Authentication as you have already logged in to your PC.

Domain User

Database administrators can add users based on their Active Directory domain accounts. To do this, when adding new users:

Select the **Add Domain User** tab. The Domain name is the name of the domain as per your active directory setup. The User name and password will be the username/password for anyone who has access to search the active directory.

Once these details have been added, the available **User Login Domains** can then be loaded using the **Load** option. There may be more than one. If the User Domain you want to use is not included (this happens on some Active Directory setups), you can type it in.



Using **Surname to Find**, you can then select and add users.

Issues with adding users and using domain login

Please note that in the current BRAHMS version, when a user logs onto their PC (not BRAHMS), it is necessary that they log in using the *same casing* for the domain and the user name as is listed in the BRAHMS user list. Or put differently, make sure that the user entries are added to the BRAHMS user table in the same case that they typically log in using. This limitation is likely to be removed in a forthcoming software update. Also, if your user's PC log in name is different to the actual domain name, when registering users, as on the above screen, you can edit the value displayed in the User Login Domain text box when adding new users.

Access and permissions

Introduction

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

With larger projects where there may be many users, the need to control access and editing rights to specific categories of data becomes ever more important. For example, only some users may be able to edit your central species list – while others may only be able to view and query this list.

The permissions and access settings can also be used to simplify the entire system for users who do not need to see the entire range of menu options. For example, a volunteer working on entering new museum accessions may have a BRAHMS interface that only shows the Rapid Data Entry menu.

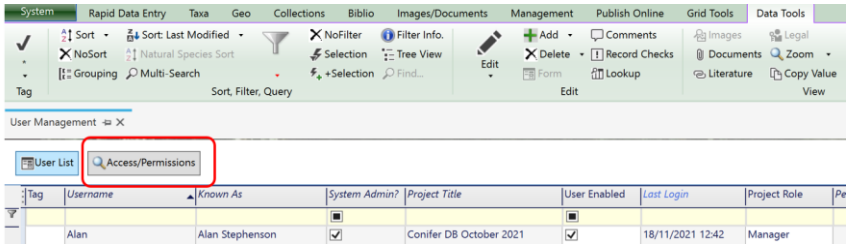
A set of permissions can be created and saved as named **permissions set**. This set of permissions can then be assigned to other users.

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 **Read Only** or **Read and Modify**.
- Where Read and Modify access is given, additionally, users can be assigned access to **Add**, **Mark records for deletion** and **Remove records marked for deletion**.
- Additional features can be edited *e.g.* the ability to **Merge records** or **Edit map points**.

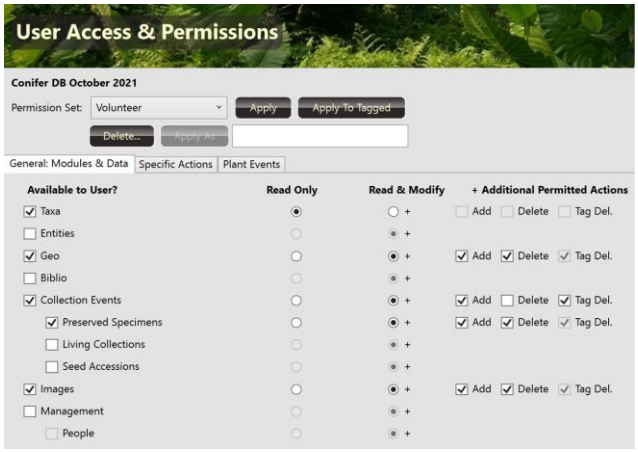
Editing user permissions

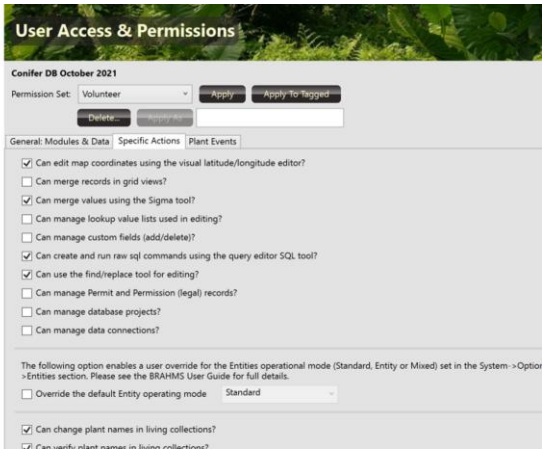
Open the User Management table using System **> Manage Users and Permissions** - then select the **Access/Permissions** option.



With the User Management table open, select the Access/Permissions option as shown here.

Options are divided across three tabs:

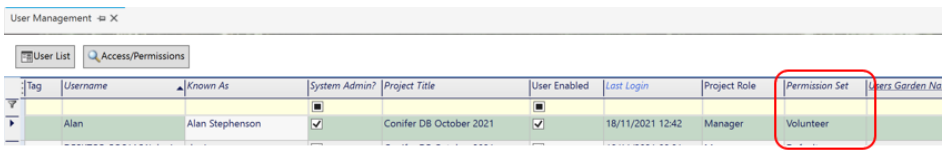




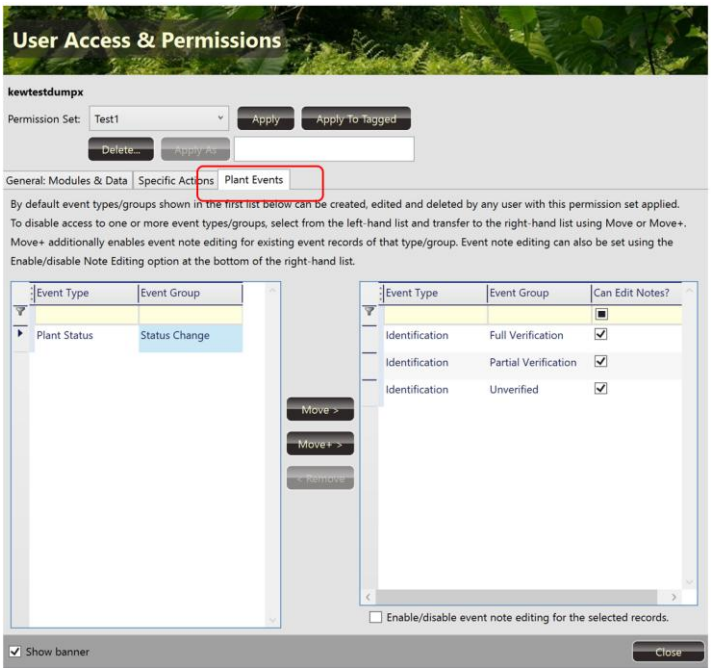
Tab1 for Modules and Data: In this example, a permissions set 'Sample profile' has been created. For example, the user has Read Only access to the Taxa module. Full access is provided to the Geographic module including the ability to Edit, Add and Delete records. On the other hand, in Preserved specimens, this user can Add and Mark records to delete but not finally delete those records. Various other settings have been provided.

Tab 2 for specific actions: Various further settings can be edited per user profile.

Once you have edited the settings, you can enter a name for this set of permissions in the **Apply As** text box. This will be enabled when you enter a permission set name. You can assign this set to other users.



Note that the permission set name appears in the user grid.



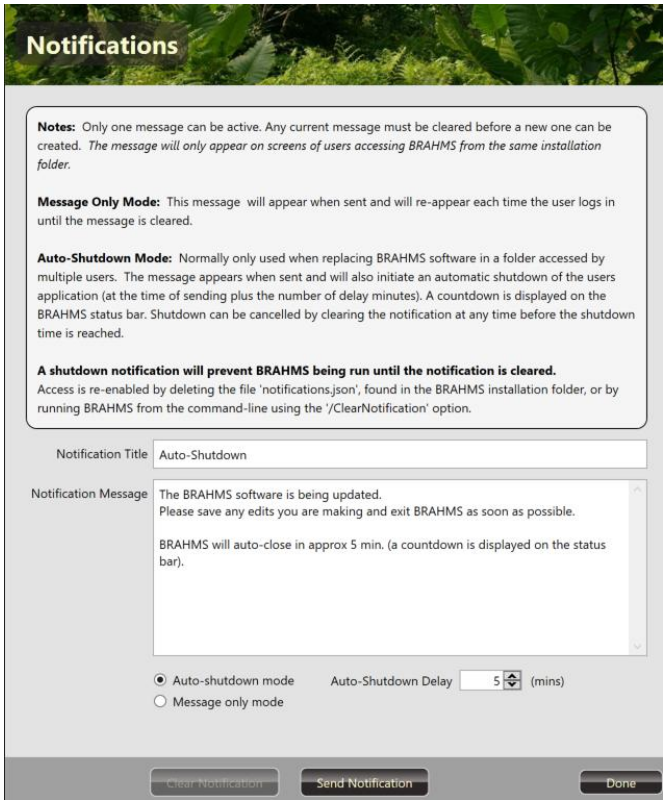
Tab3 for Events: *the options here control which users have permission to edit plant events.*

Access permissions to RDE folders

Access to Rapid Data Entry folders is discussed in the section on Assigning permissions to RDE folders.

System broadcasting

The option **System > User Notification…** can be used to send a message to all currently logged in users, as long as these users are using the same client software. While this feature can be used to distribute any message to users, one of its key purposes would be to advise users to log out so that the system can be updated.


Notifications
Notes: Only one message can be active. Any current message must be cleared before a new one can be created. The message will only appear on screens of users accessing BRAHMS from the same installation folder.
Message Only Mode: This message will appear when sent and will re-appear each time the user logs in until the message is cleared.
Auto-Shutdown Mode: Normally only used when replacing BRAHMS software in a folder accessed by multiple users. The message appears when sent and will also initiate an automatic shutdown of the users application (at the time of sending plus the number of delay minutes). A countdown is displayed on the BRAHMS status bar. Shutdown can be cancelled by clearing the notification at any time before the shutdown time is reached.
A shutdown notification will prevent BRAHMS being run until the notification is cleared.
Access is re-enabled by deleting the file 'notifications.json', found in the BRAHMS installation folder, or by running BRAHMS from the command-line using the '/ClearNotification' option.
Notification Title
Auto-Shutdown
Notification Message
The BRAHMS software is being updated.
Please save any edits you are making and exit BRAHMS as soon as possible.
BRAHMS will auto-close in approx 5 min. (a countdown is displayed on the status bar).
Auto-shutdown mode
Auto-Shutdown Delay
5
(mins)
Message only mode
Clear Notification
Send Notification
Done

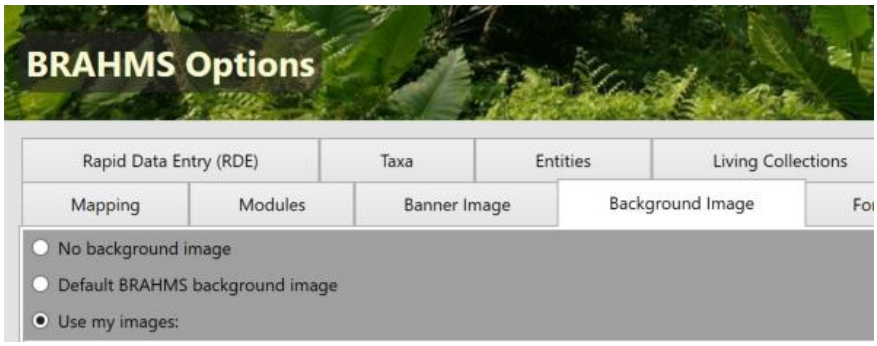
BRAHMS setup options and language

Introduction

Setup options are accessed from **System > Options…** The options are gradually expanding, those currently available are listed below. Note that user permission options are used to define user level access and permissions.

System background

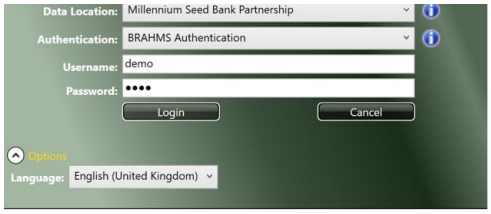
To set your BRAHMS application background image, select **System > Options > Background Image**. You can display background images from your own image gallery choosing the relevant BRAHMS setup option.

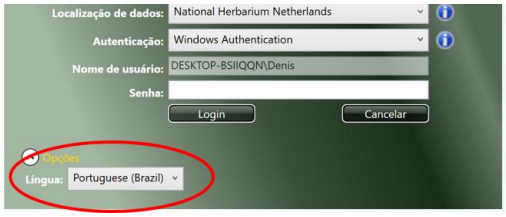


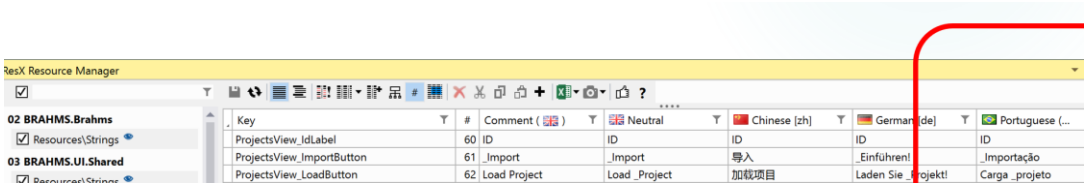
(NB The Bing image of the day option has been removed for now until we can clarify potential copyright issues)

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. The available languages are listed on the log in form under Options. If you require a different language, you can request this from the BRAHMS project.





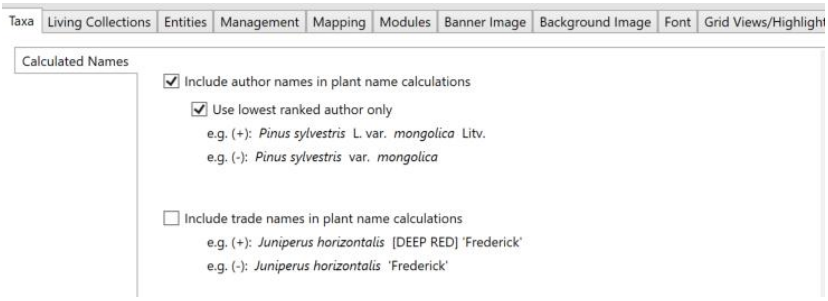


All system text that appears in the BRAHMS application is drawn from translatable resource files.

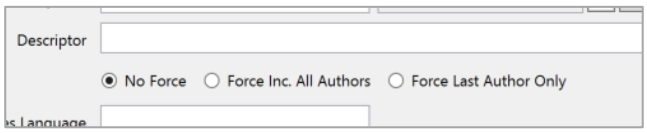
Formats for taxa names and authors

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.



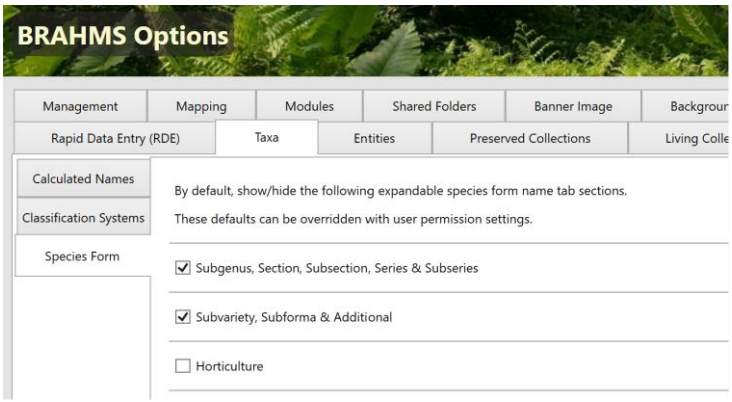
Note: If author names are excluded by default, you can override this on a name by name basis using the **Force Author options** found on the main Species form:



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.

Name epithets

Hide unwanted sections on the species form.



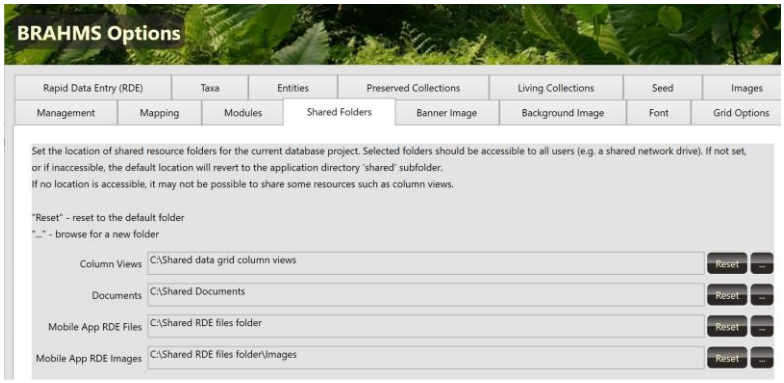
You can hide sections on the form – for example horticulture related name epithets.

Regisering your institution code

In the System > Manage Users and Permissions table, you need to use a lookup to set the User's Institution Code. The code should already be added to your Management > Address book and thus be available to add to the user file.

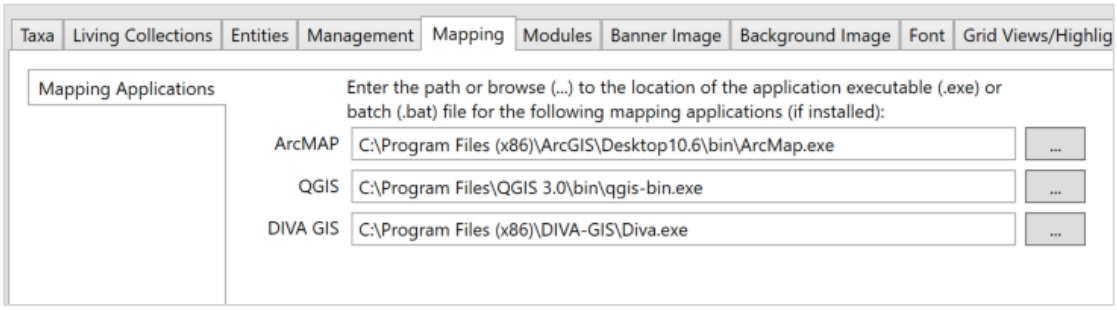
Shared folder locations

Certain files can be shared between users. These include saved columns views, documents and images. Shared folders should be accessible to all users. For further information on sharing column views see section on saving views.



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.



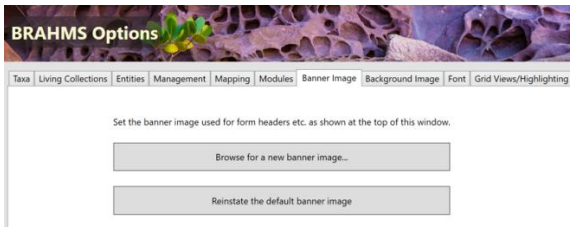
GIS exe locations.

Modules

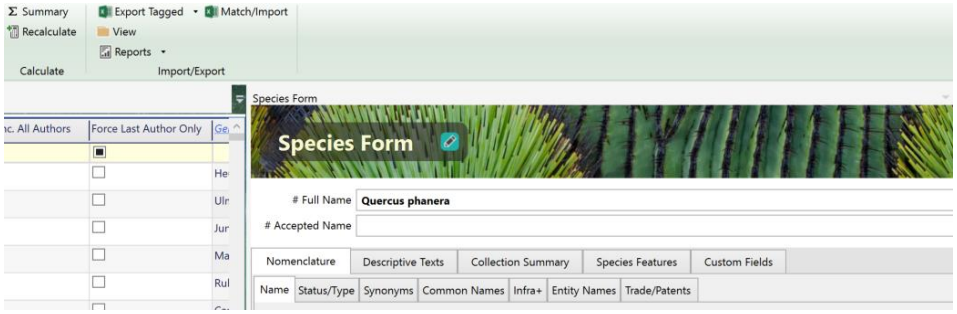
The settings here can be used by individual users to control the main menu options they see. Note that the database manager may apply restrictions using the Access and Permission settings. The access and permission settings override the user module settings.

Banner image

The selected banner image appears 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.





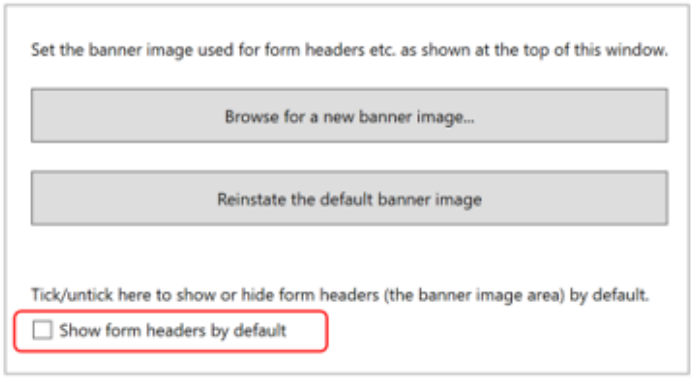


An example banner in use.

Supressing form banners

As form banners use up screen space, it can be convenient to hide these banners by default rather than hiding the banner manually from the opened form.

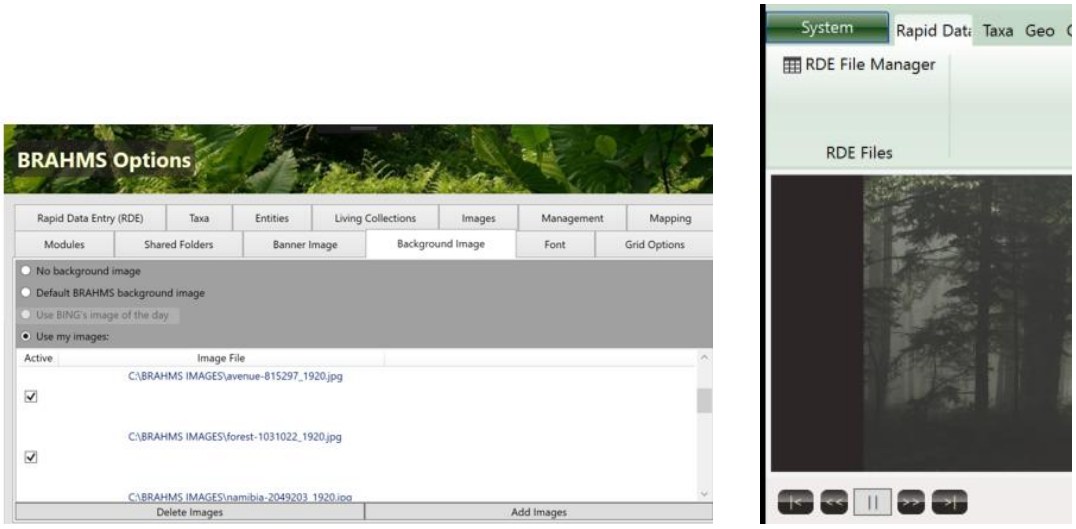




All forms have a Show Banner option. Form banners are on by default. Use the set-up option provided to hide banners by default.

Background image

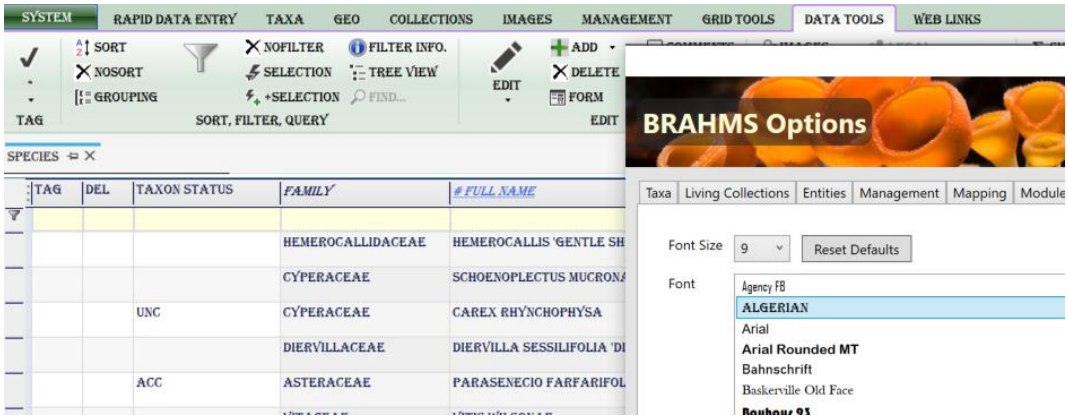
Use the settings here to choose the application background image.

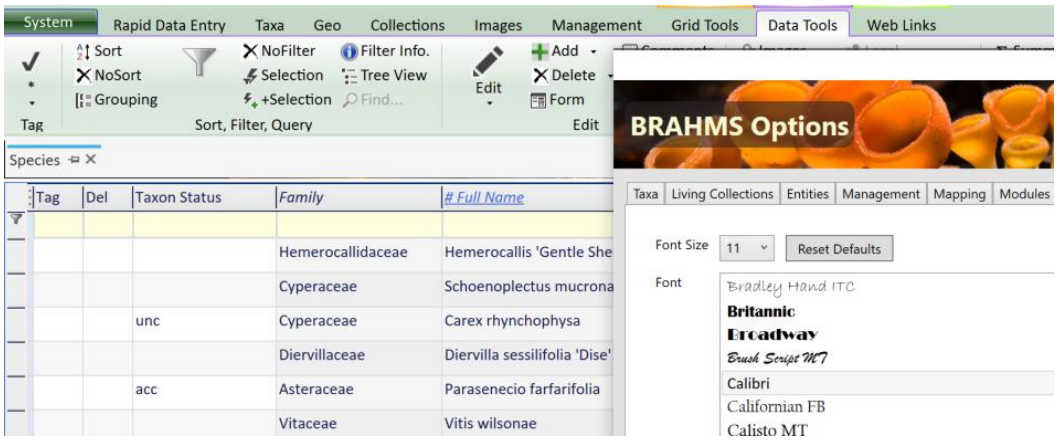


Choose your background image setting. Unfortunately, Bing image of the day is restricted to developers die to copyright restrictions. Using My images, you can register as many images as you wish to display in a cycle. You can use the controls at the bottom of the main application window to pause of step through your images.

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.

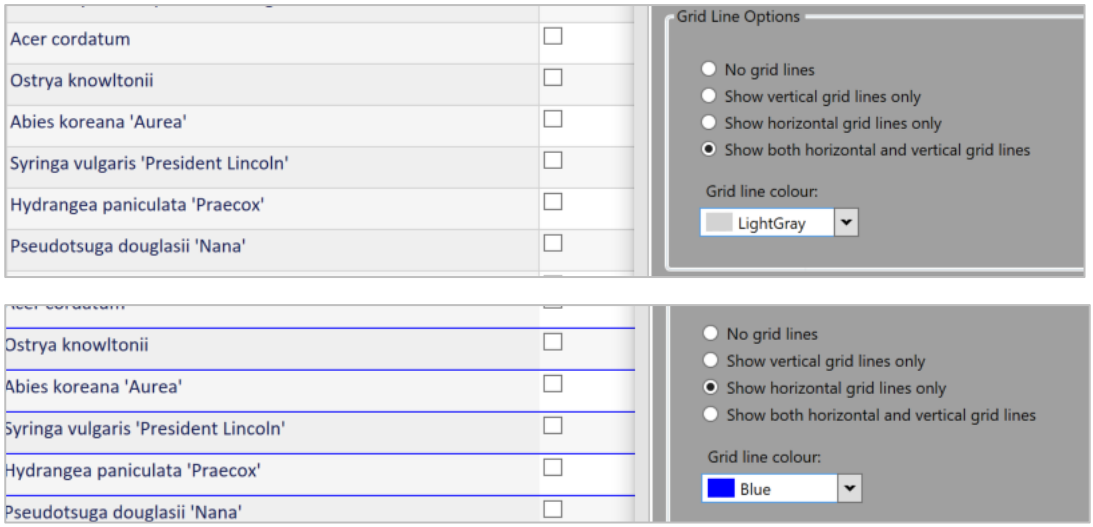
Grid Options

- Adjust tag colours for dynamic record colours
- Choose your preferred data grid line options
- Suppress column header sorting

Tag Colours

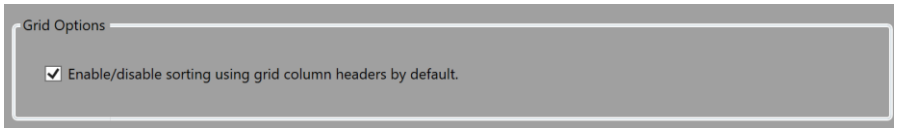
Tagging and editing tag colours are discussed in the Tagging section of this guide.

Data grid line options



Alter the appearance of your data grids.

Column sorting



Further information is provided in the section on sorting records.

Data grid fundamentals

Introduction to data grids and their 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.

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.

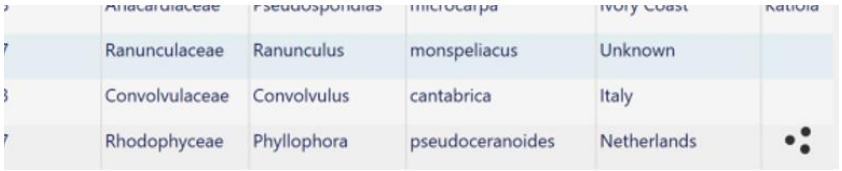


A typical data grid, here from collection events. The data in this grid example come from several tables: Tags are stored in a user-specific tag table; collector names come from the people/name-strings table; and the taxa fields some from the family, genus and species tables.

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 data 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.

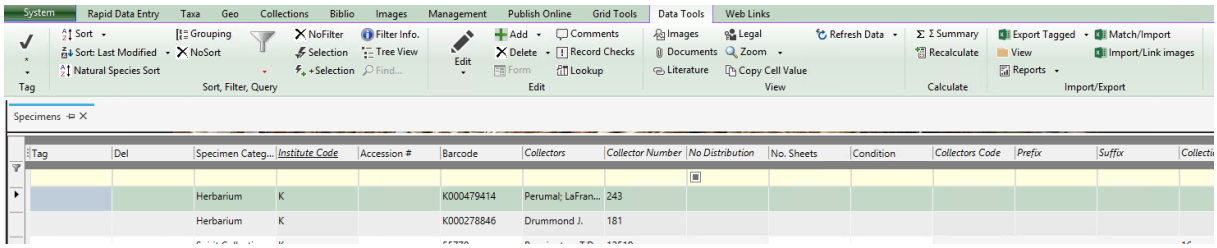


The data access triangle indicating that the system is busy pulling new data from your database into the grid.

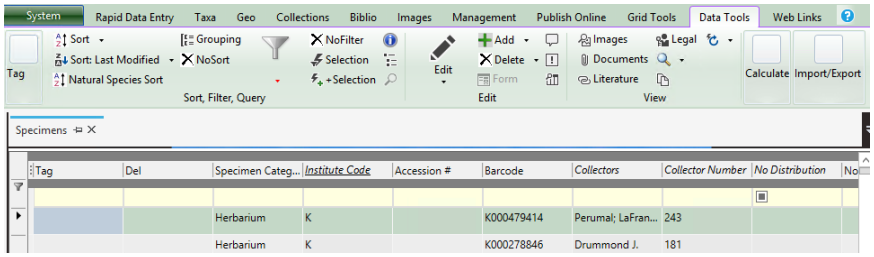
If you are working with large tables, for example those with > 500,000 records, you will experience longer delays if you attempt to drag the grid vertical scroll bar up or down. This behaviour is well documented in virtualized data grids. In practice, it is not normally necessary to use the vertical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

Working on a small screen?

Note: if you are working on a small screen, toolbars may collapse in the manner shown below.



Normal screen.



Small screen. Where toolbars are collapsed as with Tag, Calculate and Import/Export above, clicking on the toolbar option lists the hidden toolbar 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 taxa specific tools or if you want to open another taxa table, return to the **Taxa** menu - or another menu option as required.

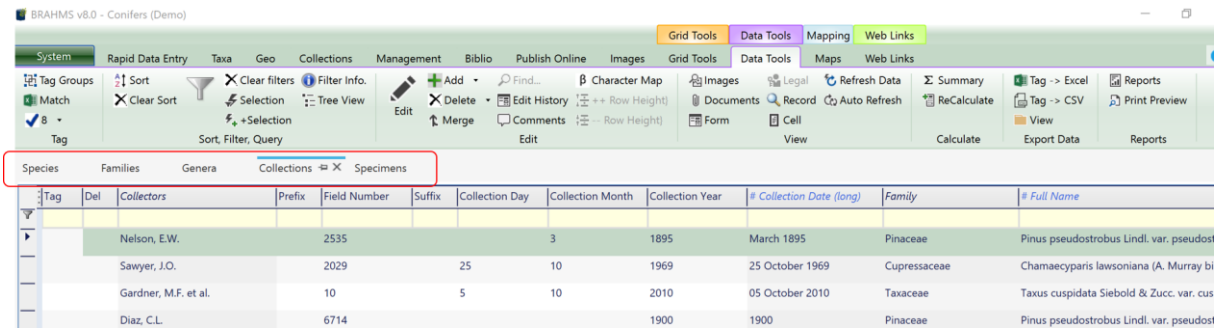
- To close a table, select X on the table Tab (as displayed above the data grid). Alternatively use **Alt+X**

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

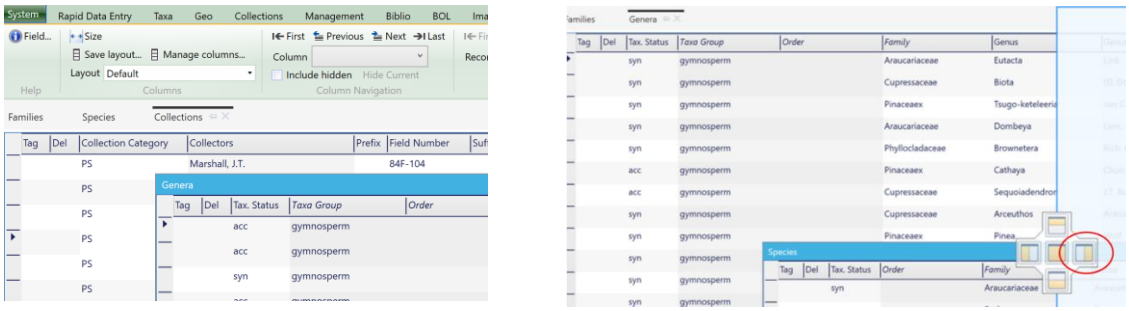
See examples on https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#multiple

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.

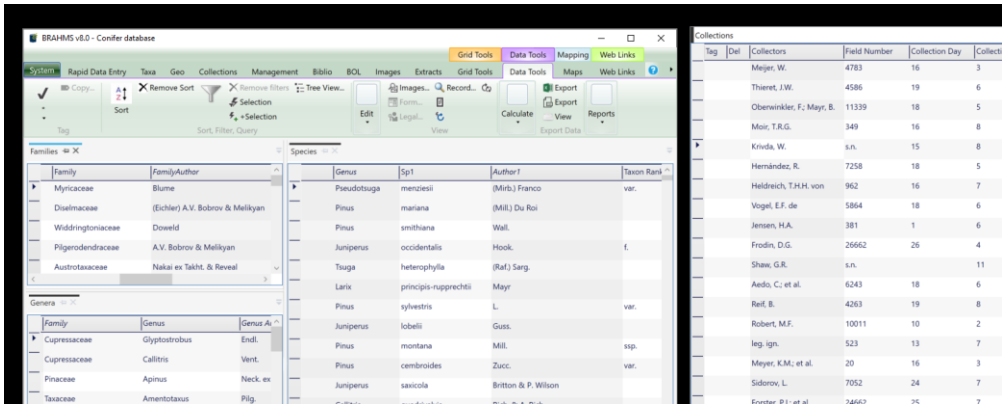
Positioning tables and other items takes a little practice as there are many potential docking options. It also depends on how many monitors you have available. The tasks here assume only one monitor – but if you have two or more, take advantage of these to display tables fully undocked.

- 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

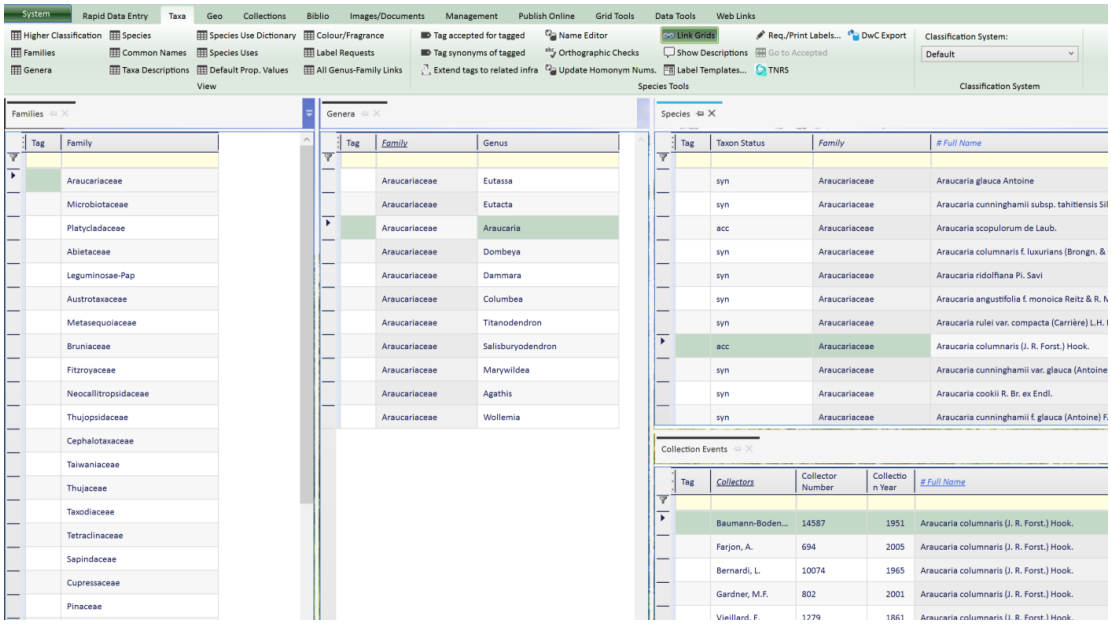


Dock position options vary depending on the windows opened. Some experimentation is required.

Dynamically linking tables

With some tables, options are provided to link the tables, parent to child, so that when you move through the parent table, the data in any linked child tables updates accordingly. An example would be dynamically linking Family -> Genus -> Species -> Collection Events. An example follows:

- Open the Family, Genus, Species and Collection Event tables.
- Optionally, dock the tables on a single or multi-monitors so that you can see these tables at the same time.
- Select the Family table and on the Taxa menu, select **Link Genera**.
- Select the Genus table and on the Taxa menu, select **Link Species**.
- Select the Species table and on the Taxa menu, select **Link Grids**.



As you browse through the family table, the data in the now linked tables will update.

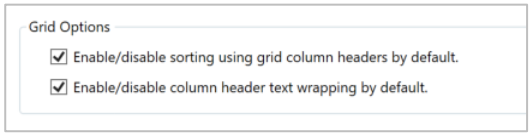
Setting grid appearance

System Fonts and grid lines

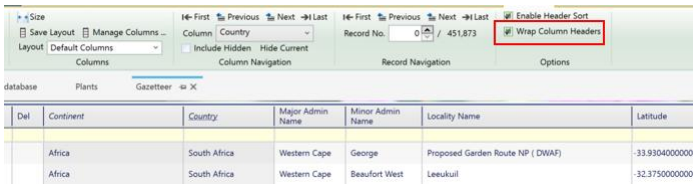
As discussed in the System settings section, you can configure grid font, text size and grid lines using the options on **System > Options .**

Header wrapping

You can optionally wrap column headers when the column width reduces. Header wrapping suits some users, not others.



*If enabled by default on **System > Options > Grid Options**, a user can always override header wrapping using the option provided on the Grid Tools toolbar.*



An example showing header wrapping.

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.

Action in non-edit mode	**Keys**
Move to the next / previous column	Right / Left Arrow
First/Last column	Home / End keys
First/Last row	CTRL Home / CTRL End
Next /Previous row	Down / Up arrow
Scroll up and down	PgUp / PgDn
Select or activate a column or cell	Click in the cell
Action in edit mode	**Keys**
Move to the next / previous column	TAB / Shift TAB
Next /Previous row	Down / Up arrow or use Alt+Arrows in memo or numeric fields

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. Sort list of functions by clicking on columns.

Modifier	Key	Action
	Delete	Toggle records delete flag and move to next record
Control	E	Toggle edit mode for the current grid
Control	End	Go to last row and column
	End	Go to last column
Shift	F1	Toggle this list of shortcuts
Control	F11	Deactivate all currently applied filters
Shift	F11	Set current cell value as a quick filter
Alt	F11	Create grid column range filter
	F11	Toggle advanced query tool visibility
Shift	F12	Append current cells value to quick filter list
Shift	F2	Toggle grid form visibility
Control	F2	Toggle Sigma summary visibility
Alt	F2	Toggle Sigma summary (+) visibility
Shift	F4	Copy and increment numeric field from record below (edit mode only)
	F4	Copy field from record below (edit mode only)
Control	F4	Copy current record to a new record (edit mode only)
	F5	Refresh data grid
Control	F5	Remove any existing sorts
Control	F6	Untag all records in the grid
	F6	Toggle records tag and move to next record
Shift	F6	Tag all records in the grid
Shift	F7	Toggle grid cell content viewer visibility
	F7	Toggle Zoom visibility
Shift	F8	Cycle column autofit widths
	F8	Toggle column manager visibility
	F9	Open value look-up for a read-only field if available (edit mode only)
Control	G	Toggle visibility of grid data grouping area.
Control	H	Toggle Find and Replace
Control	Home	Go to first row and column
	Home	Go to first column
Alt	I	Copy and increment numeric field from record below (edit mode only)
Control	K	Copy current cell value to clipboard
Control	L	Open value look-up for a read-only field if available (edit mode only)
Alt	M	Toggle magnifier window
Control	N	Add a new record
Control	P	Toggle grids print preview visibility
	PgDn	Scroll down
	PgUp	Scroll up
Control	R	Toggle Reporter visibility
Control	T	Show tagged records only
Control	U	Show my data only
Alt	V	Toggle visibility of record verification tool.
Alt	X	Close the active grid view
Alt, Control	Z	Toggle grid cell content viewer visibility
Alt	Z	Toggle Zoom visibility

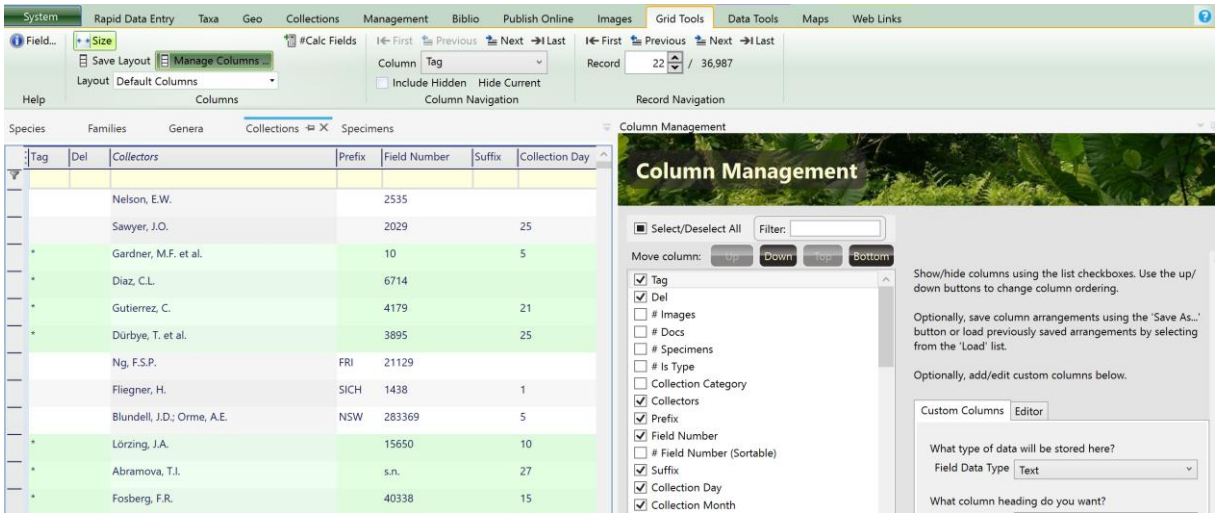
Adjust, save and share grid column views

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

Adjusting data grid views

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

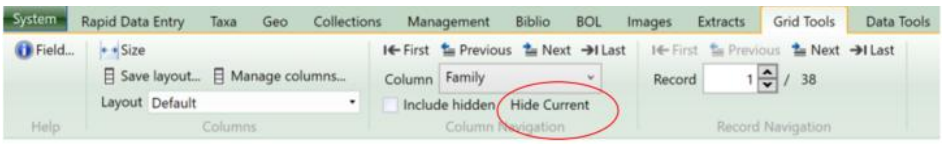
- Select **Grid Tools > Manage Columns…** .



The Column Management Tool allows you to select visible columns.

Note that on this form you can use the **Select/Deselect all** option to quickly edit the selections. For example, you can deselect all and then choose the columns you want one by one. Also note the **Filter** option which is useful to quick locate fields in the list.

Another handy option is the Hide Current option on Grid Tools – this hides the currently selected field. If you click on this option again, it will hide the next column in the grid.



You can also **right-click** on any of the column headers. This opens a dialogue form with options to show hidden columns and alter the column order.

Saving data grid views

Multiple data grid views can be saved per table. Once you have designed a useful selection of fields, you can save this using the **Save As** option on the bottom of the Column Manager form. This will ask you to provide a name for the saved view. You can also save views using **Save Layout** on the **Grid Tools** toolbar.

Default view file types and folder location

By default, all saved view files are stored in your Documents\BRAHMS\Columns folder. In this folder, you may find the following file types:

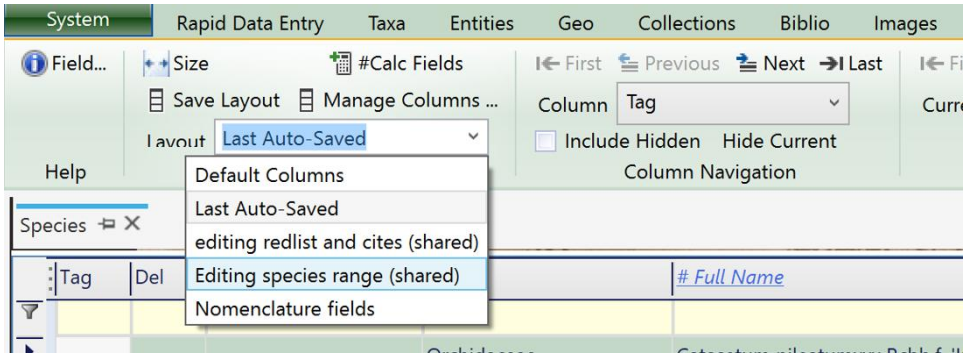
- .lcv files are for your last column views, one per table.
- .dgc file are for your saved data grid views.

Deleting data grid view files

To delete any data grid view, go to the view file folder location and simply delete the physical view file.

Sharing saved grid views

As an institution, you will likely want to set up commonly used grid views for different tables and share these with all system users. To do this, you simply copy the grid view files from the default Documents\BRAHMS folder into the BRAHMS application folder Shared/Columns.

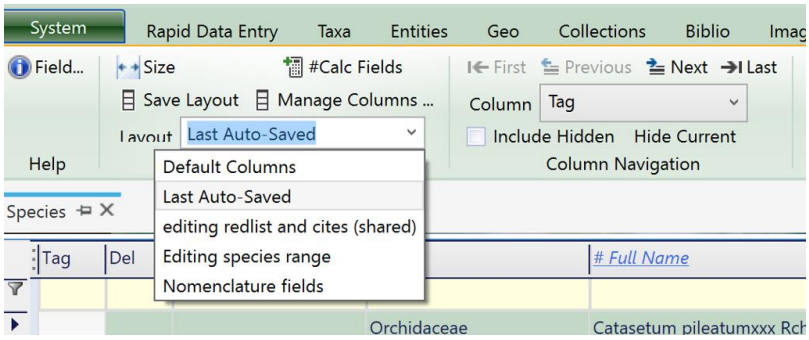


Views moved to the BRAHMS application Shared\Columns folder will be available to all users. These views have (shared) appended to the view name.

Selecting a saved view

On the Grid Tools toolbar, all saved views are listed and can be selected using the **Layout** dropdown. Here you will find, together with any views you have saved:

- Default Columns: returns the grid view to the system default.
- Last Auto-Saved: shows the view selected when you last closed the table.



Sorting records

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

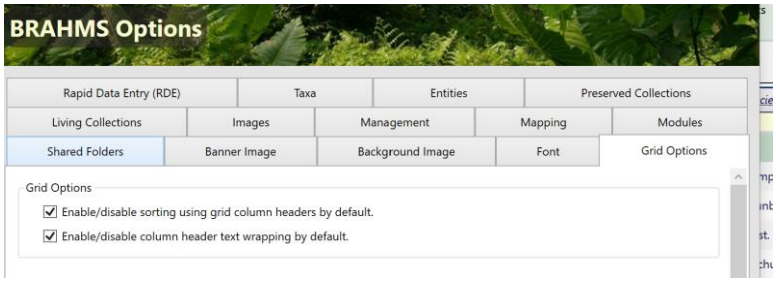
The ability to sort records, aside from being vital for reporting, is also useful to simply locate records and to find errors.

Column sorting

Enable column sorting

With column sorting enabled, you can quickly sort data grids by clicking on a column header or, as discussed below, select multiple headers. However, in very large databases, you may want to prevent users 'over-clicking' on column headers, sometimes when they simply want to select a column rather than sort.

Column sorting can be enabled/disabled by default for all users using **System > Options > Grid options**



Enable column sorting by default by setting the option on **System > Options > Grid options**.

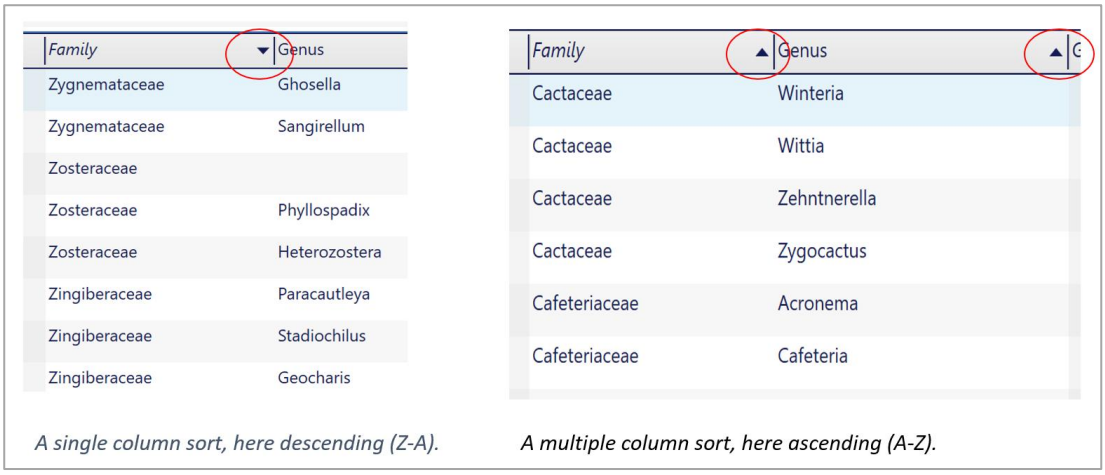


If disabled, a user can override the default settings using the options provided on the Grid Tools toolbar.

Sort on single or multiple columns

If enabled, 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.



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

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

Sort by Last Added and Last Modified

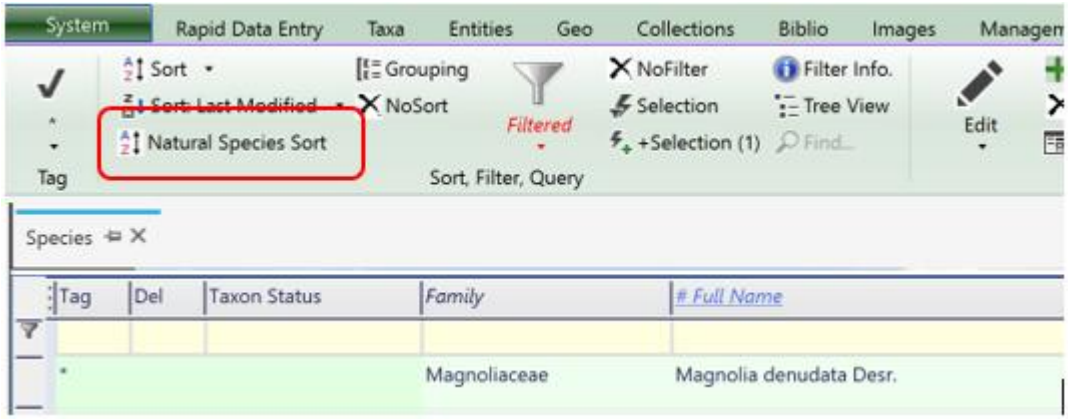
You can quickly sort of the records in the current table most recently added or modified using the options provided on the Sort menu. These records will come to the top of the table.



Select this option to see the most recently edited records. The drop down is used to access the Date Created sort.

Sorting species in Natural Order

Species records can be sorted so that the names come in AZ order regardless of which epithets are added.



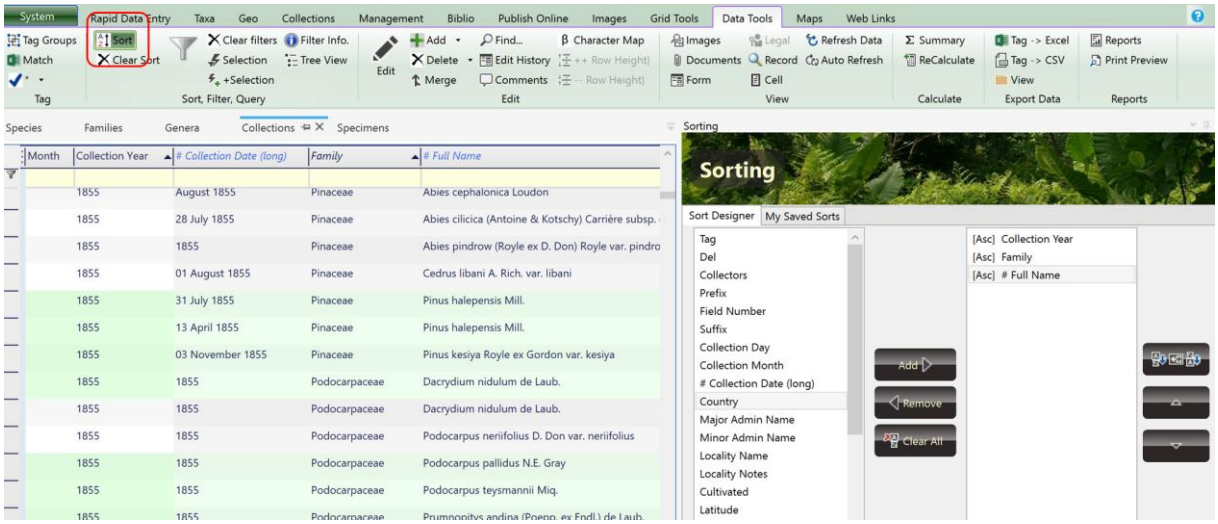
Full Name
Magnolia 'George Henry Kearn'
Magnolia 'Galaxy'
Magnolia 'Full Eclipse'
Magnolia 'Genie'
Magnolia 'Elizabeth'
Magnolia denudata Desr.
Magnolia fordiana Hu
Magnolia foveolata (Merr. ex Dandy) Figlar
Magnolia fraseri Walter
Magnolia globosa Hook.f. & Thomson
Magnolia grandiflora L.

Full Name
Magnolia denudata Desr.
Magnolia 'Elizabeth'
Magnolia fordiana Hu
Magnolia foveolata (Merr. ex Dandy) Figlar
Magnolia fraseri Walter
Magnolia 'Full Eclipse'
Magnolia 'Galaxy'
Magnolia 'Genie'
Magnolia 'George Henry Kearn'
Magnolia globosa Hook.f. & Thomson
Magnolia grandiflora L.

The names on the left are sorted by genus + species. Those on the right are sorted using the Natural Species Sort option.

Saving complex sort commands

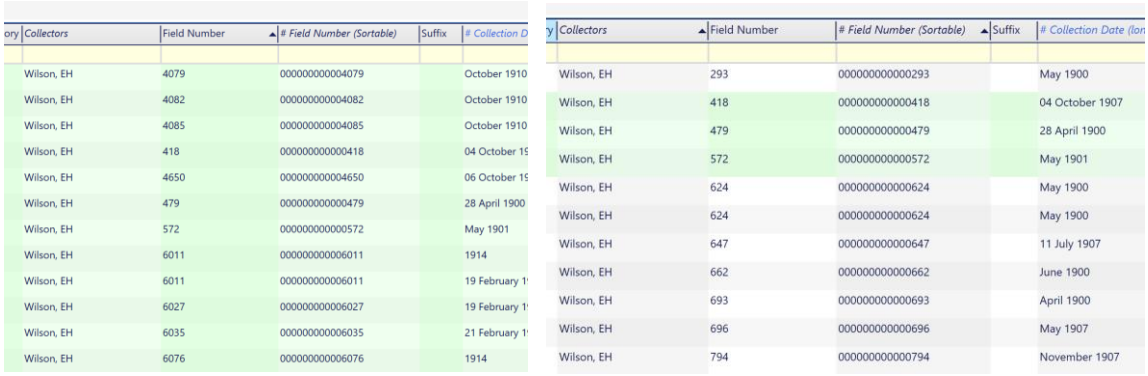
- Now open the **Sorting** tool. Here you can add fields of any type to create complex sorts. You can save complex sorts using the **Save** option provided.



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.



Collectors	Field Number	# Field Number (Sortable)	Suffix	# Collection Date
Wilson, EH	4079	000000000004079		October 1910
Wilson, EH	4082	000000000004082		October 1910
Wilson, EH	4085	000000000004085		October 1910
Wilson, EH	418	000000000000418		04 October 19
Wilson, EH	4650	000000000004650		06 October 19
Wilson, EH	479	000000000000479		28 April 1900
Wilson, EH	572	000000000000572		May 1901
Wilson, EH	6011	000000000006011		1914
Wilson, EH	6011	000000000006011		19 February 1
Wilson, EH	6027	000000000006027		19 February 1
Wilson, EH	6035	000000000006035		21 February 1
Wilson, EH	6076	000000000006076		1914

Collectors	Field Number	# Field Number (Sortable)	Suffix	# Collection Date (lon
Wilson, EH	293	000000000000293		May 1900
Wilson, EH	418	000000000000418		04 October 1907
Wilson, EH	479	000000000000479		28 April 1900
Wilson, EH	572	000000000000572		May 1901
Wilson, EH	624	000000000000624		May 1900
Wilson, EH	624	000000000000624		May 1900
Wilson, EH	647	000000000000647		11 July 1907
Wilson, EH	662	000000000000662		June 1900
Wilson, EH	693	000000000000693		April 1900
Wilson, EH	696	000000000000696		May 1907
Wilson, EH	794	000000000000794		November 1907

*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).

Sorting in reports

Also note that you can add sort commands to reports – thus avoiding the requirement to sort your data before reporting. Also note that you can use sort functions in reports, for example, sorting an alphanumeric text field numerically. Further information is provided in the Reports section.

Tagging functions

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

Video*:* 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.

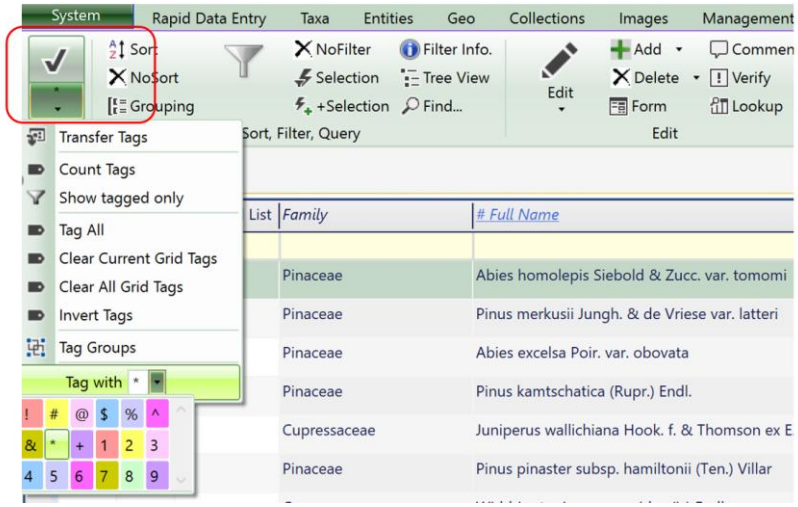
Tags are user-specific, thus one users' tags do not interfere with those of another working in the same table. This is achieved by holding tags in a related table that includes the table name, the record GUID, the tag character and the user ID.



*Select **System > Options >Grid Views/Highlighting** to edit the default colour options.*

How to tag and untag individual records

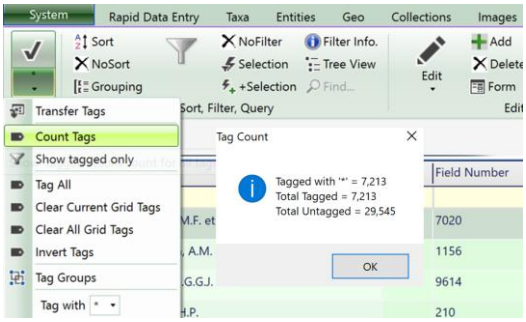
You can use the toolbar option (large tick icon), press F6 and or, if you are not in Edit mode, double-click a record. If you are in Edit mode, you can double-click in the Tag field.



*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

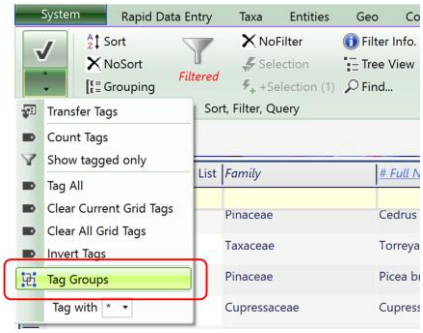
The Tag toolbar dropdown provides a list of handy tagging options.



Transfer tags	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.
Count tags	A simple count of all tagged records.
Filter on tagged	Show only tagged records
Tag all	Tag all records in table – respecting any filters
Clear all grid tags	Remove your tags from all tables – does not respect filters
Clear current grid tags	Remove your tags from the current table – respecting current filters
Invert tags	Tagged records are set to no tag; records that had no tag are tagged *
Tag with	Choose tag symbol from list

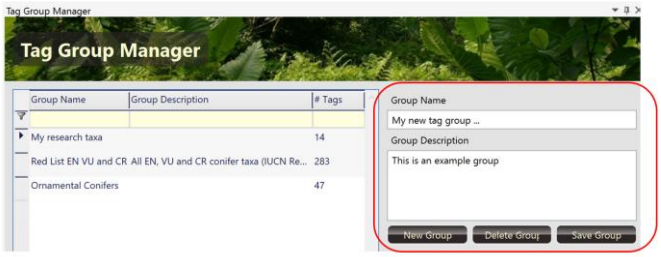
Tag groups

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.

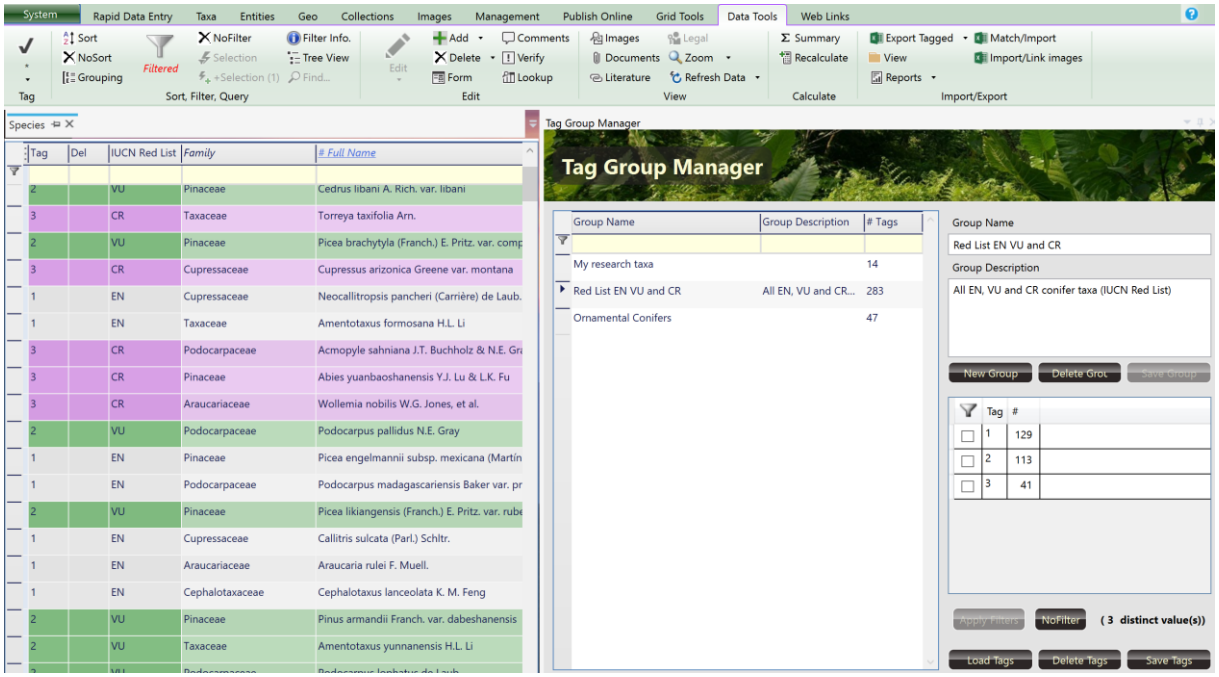


To create a tag group in any table:

- 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



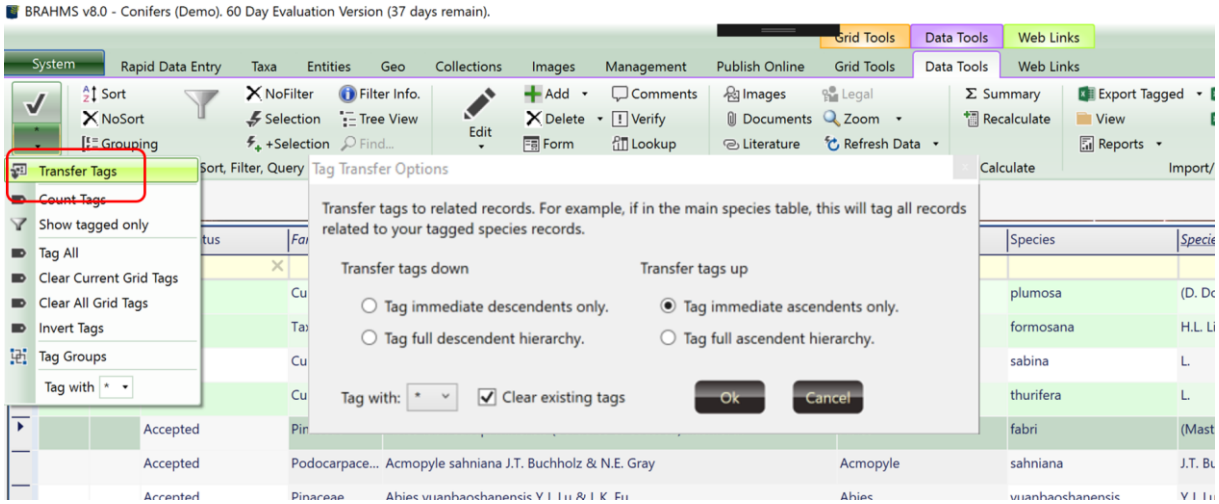
An example of Tag Groups. In this example, records with Red list code EN VU and CR have been tagged with the symbols 1, 2 and 3 respectfully and these tagged records have been saved to a group called 'Red List EN VU and CR taxa'

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.



The transfer tags option.

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

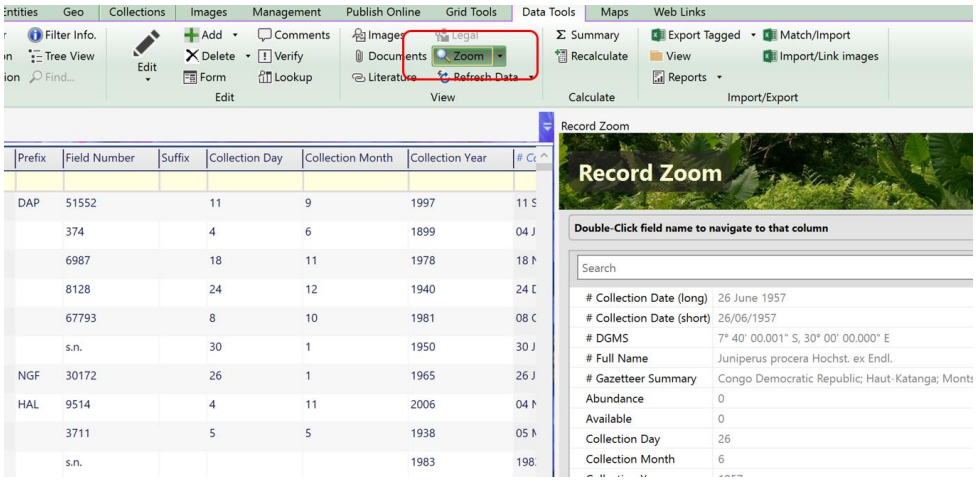
Using the **Match/Transfer** option, you can tag records in the open table that match criteria in a selected Excel XLSX table. This option is described in the Match/Transfer data section.

Record Zoom and Cell options

Zoom option

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.

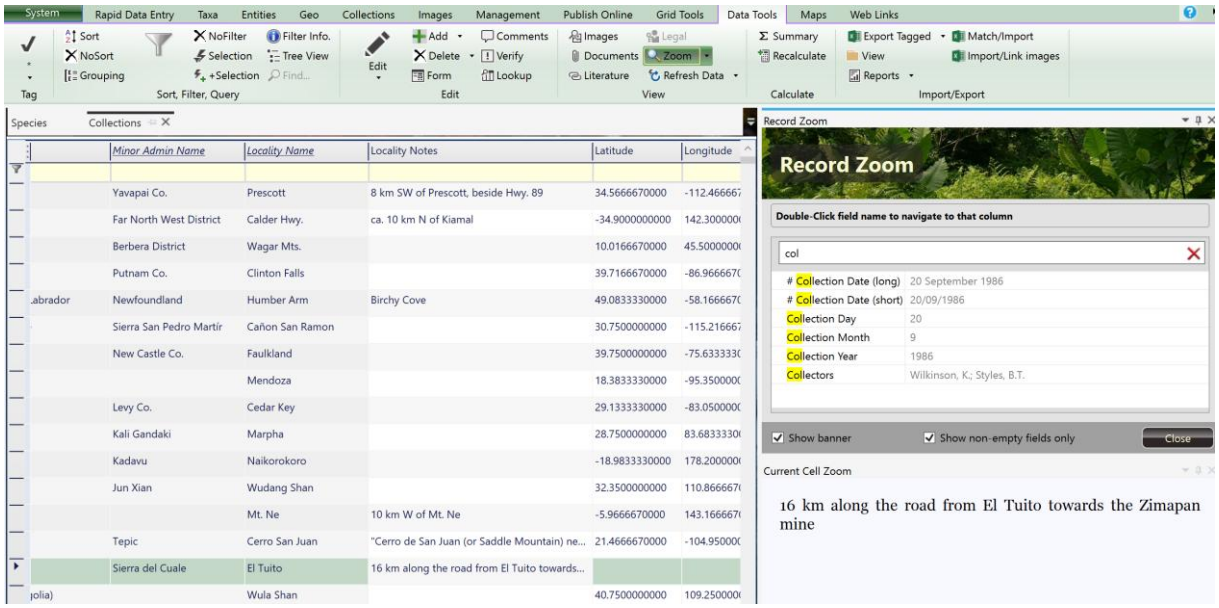
It also provides a useful way to navigate to data grid columns - double-clicking on a field name locates the column. If the column is not currently visible, it will be set to visible.



The Record Zoom window. Double clicking on any field name in the Zoom window (here Family) locates the selected column in the data grid.

Cell option

The Cell option on the Zoom dropdown opens a docked window displaying the value of that data field. The window content updates as you move field or record. Also see the copy options in the section Copying cells and records.



*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**.*

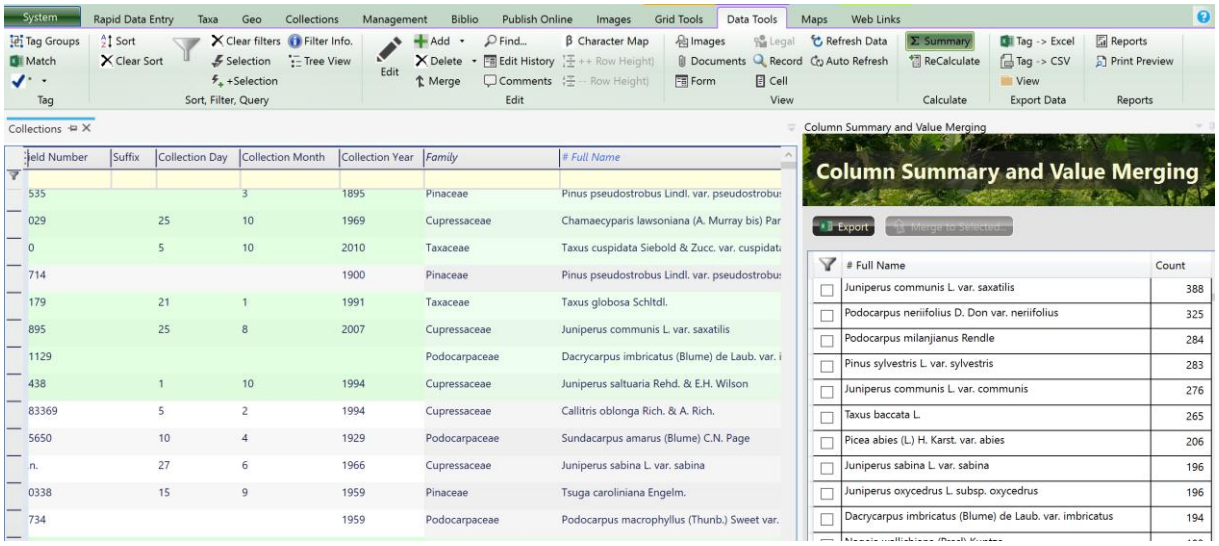
Column summaries

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

List values with totals 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.

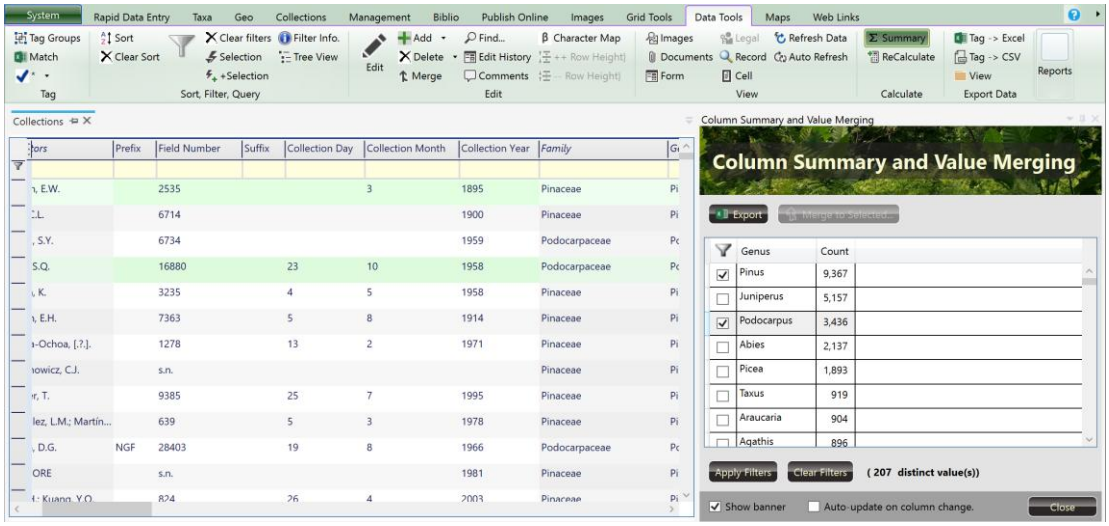


*Here, the summary shows the number of collection events per species. Moving to a different column will update the summary – assuming **Auto-update on column change is selected**. Click on the summary columns to sort by field name or count.*

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.

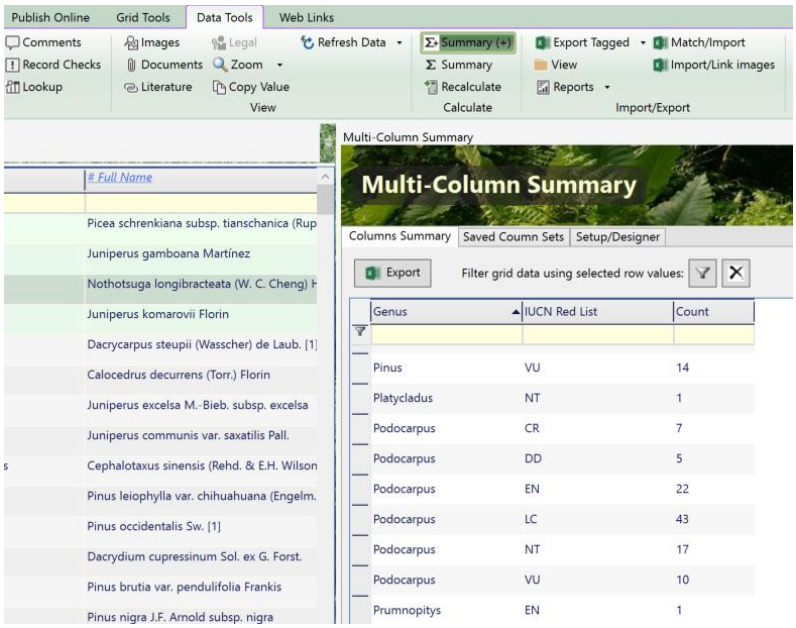
Value merging

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.

Multi-Column Analysis

The multi-column analysis tool allows to select any columns that are set to visible in your grid view and then total up the number of records for each combination of records. Thus, if you choose family, country and year, the totals will be the number of records (in the current table) per different family+country+year combination.

The Setup/Designer tab provides option to select and adjust columns including column order.



An example in the species table. You can sort and filter on the analysis results. The results can also be exported to Excel. Using the Filter option, you can filter the main data grid to the selected analysis row values.

See below on how this tool can be used to mark record duplicates.

Locating and marking duplicated records for deletion

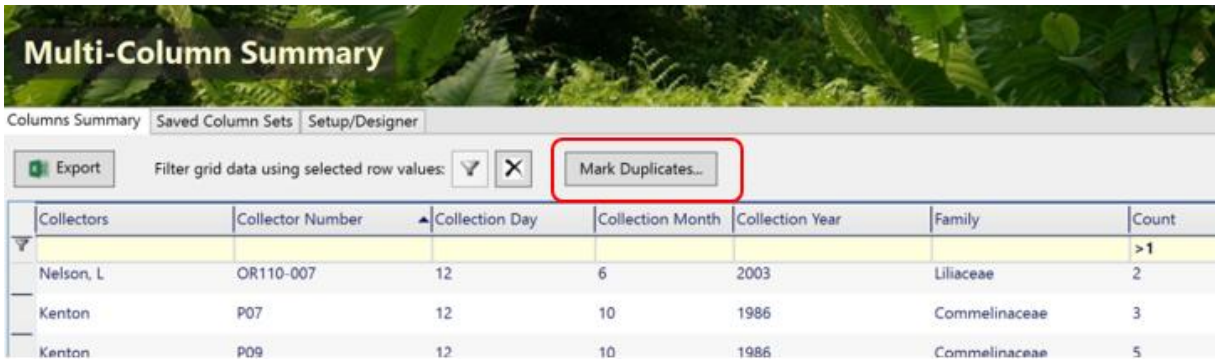
Over time, your database may build up a number of duplicated records which you may want to remove. This does not refer to the word 'duplicate' in the sense of duplicated collections (specimens, plants seed, and the like) but rather to records where the same information has been entered more than once.

Duplication can happen for a variety of reasons. The simplest reason is that a record is accidently added more than once. Another cause would be if an RDE file has been imported more than once or there may have been a problem where an RDE had to re-imported. With some categories of data, BRAHMS prevents duplication – but in other cases, it is not possible. An example would be with plant event records.

You can use the multi-summary tool to identify duplicated records in any table by selecting all the data columns you wish to compare. The tool totals up the number of records that share exactly the same values for all the fields you include in the summary. If the Count is > 1, then the data are duplicated based on your selection of columns.

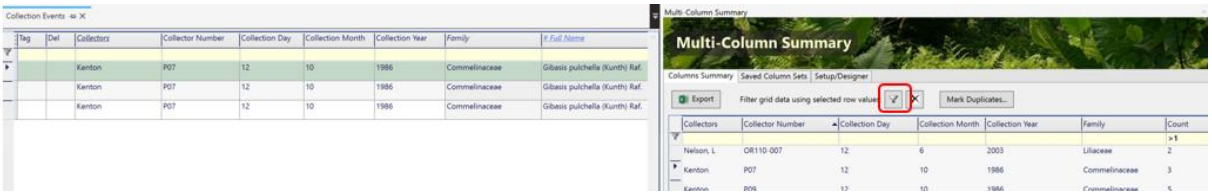
Bear in mind that if you select too few columns, the duplication is not necessarily a true duplication. For example, if your choose family + genus + species name in the collection events table, the count will reflect how many collection event records have the same family + genus + species. However, if you choose e.g. Collector + number + Day + Month + Year + Genus + Country – and still have duplication, this may suggest there is a genuine duplication.

Once the multi summary is complete, you can use the **Mark Duplicates** option to mark duplicated records for deletion (*i.e.* adds * to the DEL field). This only takes place for records where the Count value is > 1. And then you could proceed to delete these records in the standard way.



*Use **Mark Duplicates** to flag up records for deletion.*

Note that you can use the **Filter** option to auto-filter to records in the grid that match the current selection. This is a useful way to check that the process has worked as expected for you.

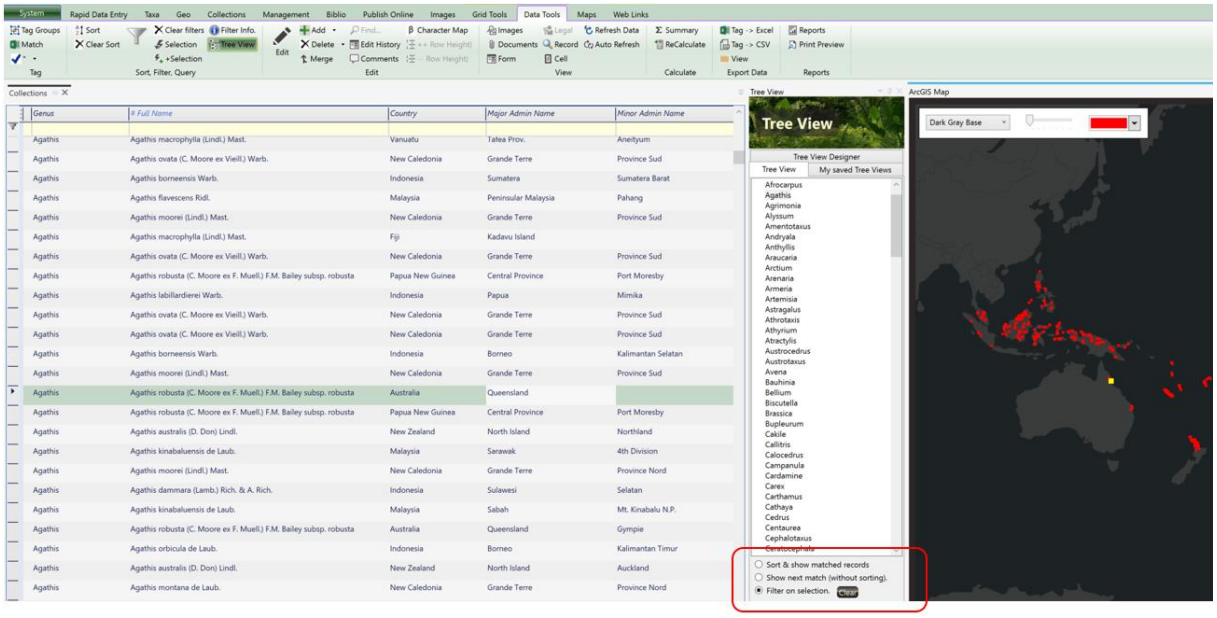


Here, the filter is used to find the 3 identical records in the main grid where they can be examined.

Tree views

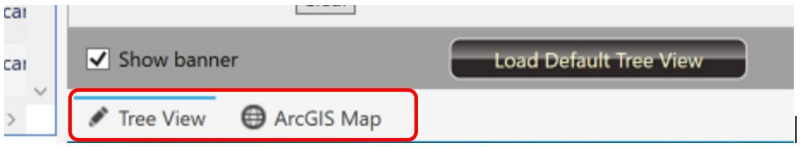
See examples on https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#treeviews

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.

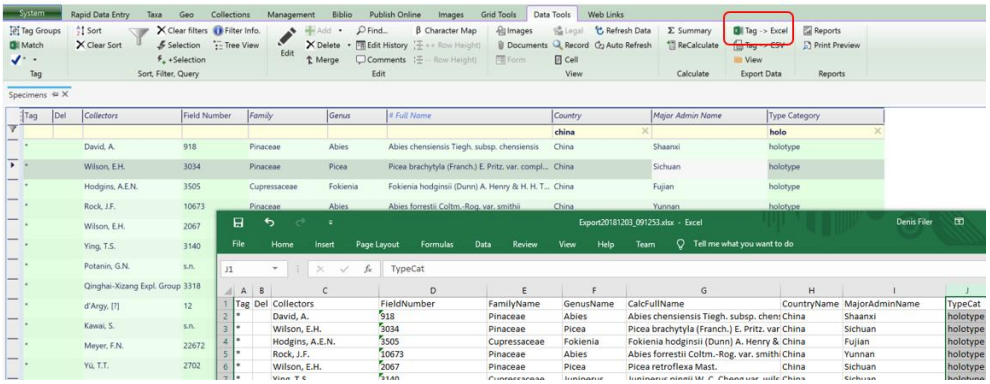
Saving data to Excel or CSV

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

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.

Copying cells and records

Copy records

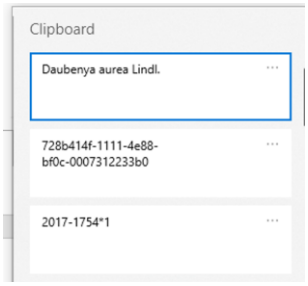
In data grids, you can click on a record to select the record. You can use Shift Click to select groups of contiguous records or CTRL Click to select individual records – the same as in other packages. Selected records are displayed in a shaded colour. Copy the selection using Ctrl+C. You can then paste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

Copy Cells

You can copy the value of a cell to the clipboard using the toolbar option **Copy Cell Value**. The short cut key for this is Ctrl+K. This is a handy way to copy GUID and other data values.



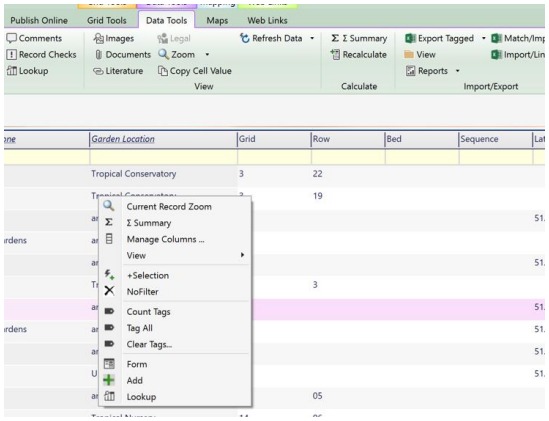
Note that by using **Windows Key + V**, you can list recently copied data values on your clipboard. You may have to allow Windows to do this.



Use Windows+V to expose data recently copied to your clipboard.

Data grid right-click menu

A right-click on the data grid provides access to a handy list of options that are otherwise available on the Grid Tools and Data Tools toolbars.



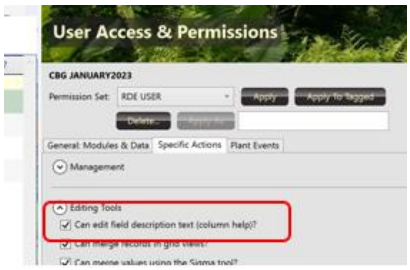
Short cut menu opened using a right-click anywhere in the data grid. Some options relate to the current column or cell value.

Field level help

While some default field level help is provided with BRAHMS, for convenience, as from v8.5.1, projects can add and edit their own field help text. With any grid opened, use the shortcut **Ctrl+I** or select **Grid Tools > Field Help.** The field help form stays open and updates as you switch fields in the data grid.

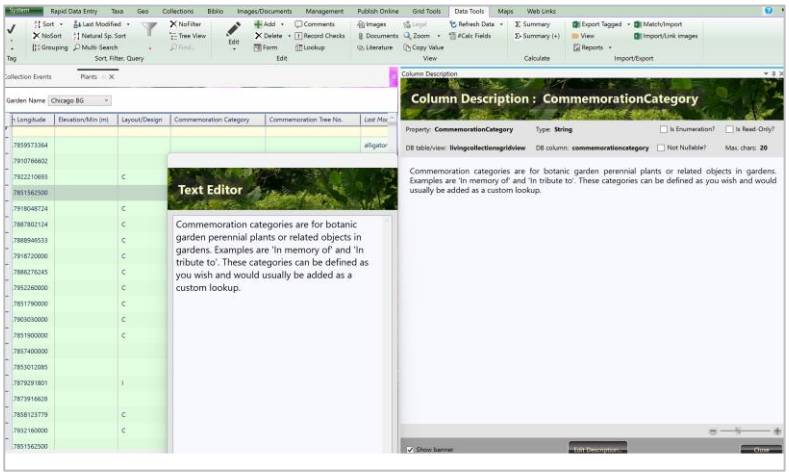
Adding or editing help text can be useful if you want to advise users on your own data standards, rules and formats – or simply provide guidance on what data to add to a specific field.

If a user has permission allocated on the **System > Users & Permissions > Specific Actions > Editing Tools > Can edit field description text,** then that user would be able to edit the field level help text using the Edit Description option provided at the bottom of the text form. Note that Admin level users can always edit the help text. Editing text will overwrite the default text that may have been provided with BRAHMS.



The field help form also provides key details on the selected field properties such as its physical table name, max size and read-write status.

Field level text is stored in your database and is visible to all users. As this help text is stored in your database, it is never overwritten when you update the software. Thus, it is equivalent to data in any other table.



Editing help text for the field Commemoration Category in the main plants table.

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. Procedure you can use to filter/query and locate your data are described in this section.

Quick filter options

Filter to show your own edits

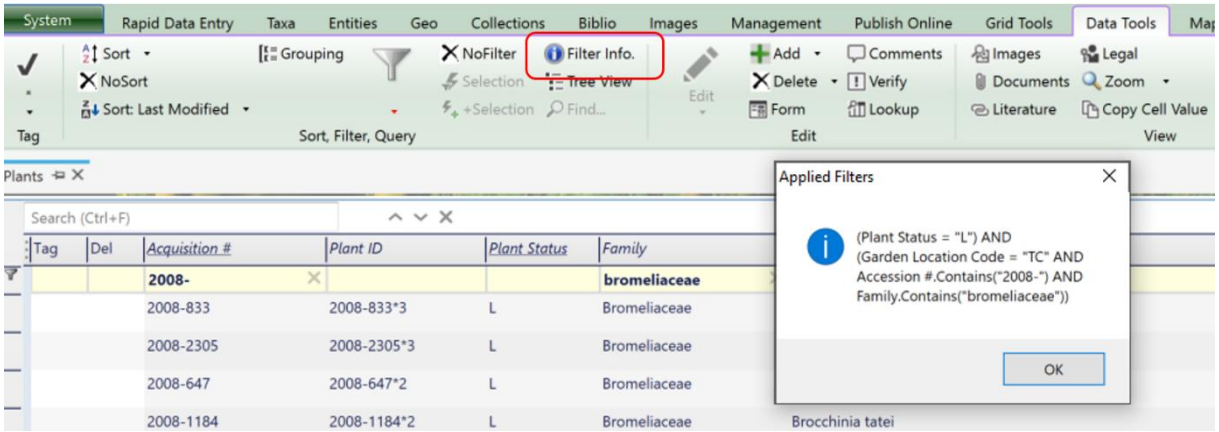
To show only those records you (as the currently logged in user) have edited, select the Filter option dropdown *Show my edits only.* This will add to any other filters you may have in place.



Restrict to tagged

The *Show tagged only* option (see above screen) filters on tagged records adding this filter to any other filters you may have in place.

Display active filter criteria



Queries using the data grid filter bar

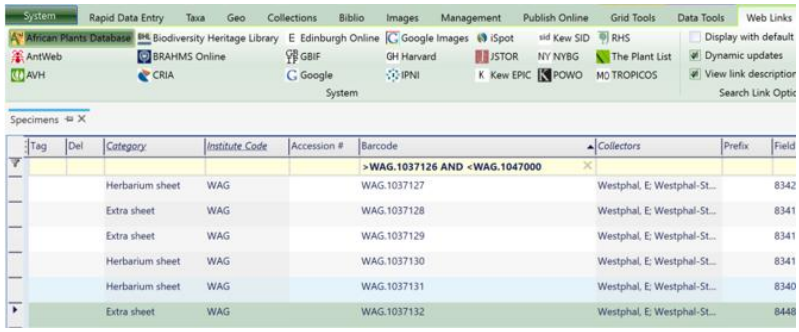
See examples on https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8#explore

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 =, <, >, <=, >= to combine values using capitalized AND/OR statements.
- You can also use keywords NOT =Null (or use <> NULL) to show non-empty strings or =NULL to show empty strings.

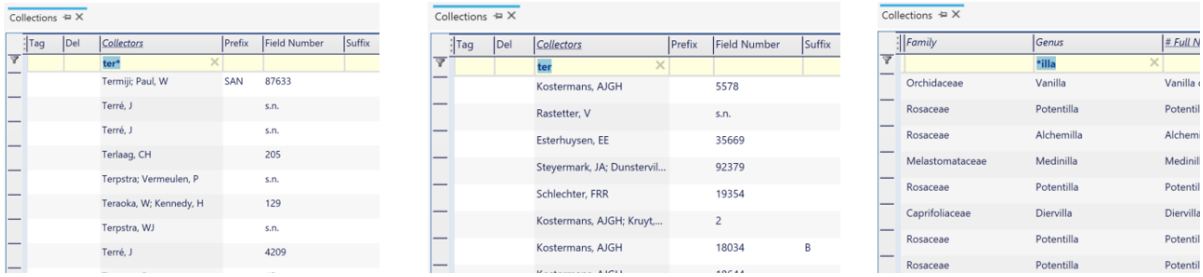


Using the grid filter row, you can add values to as many columns as needed.



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’.

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.
<>NULL :	Entering <>NULL in a column would exclude all NULL values.

*Press **SHIFT+F1** to open help option for F keys and grid filter syntax examples.*

Using Conditional Operators in filter-bar searches

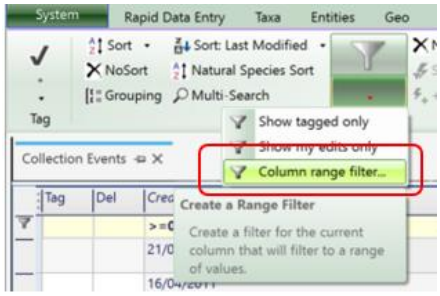
The items in a column can be filtered according to more than one value by separating those values with the AND or OR conditional operators.

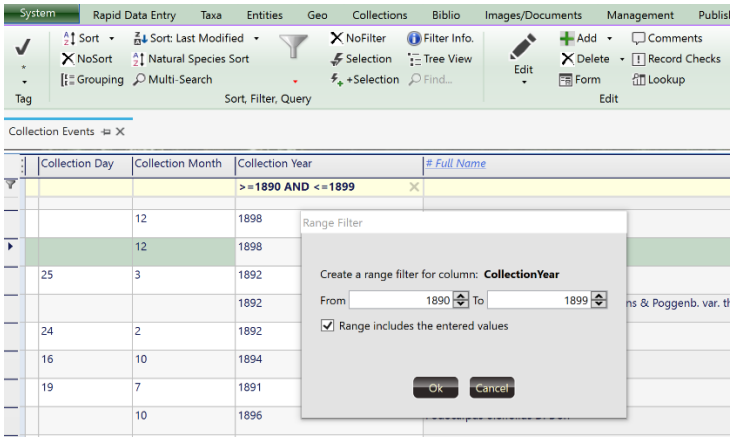
These operators must be in uppercase.

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. scopulorum.
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.

Column Range Filters

This option, found on the **Query tool** drop-down, can be used on any non-boolean column to filter on a range of values. Perhaps its greatest use is when searching on dates and date ranges (see below in date filter section). However, it can also be used in numeric and character fields. Caution with the 'Number' field in Collection Events as this is in fact a character string field.





An example filter on a range of collection years. The range tool auto-adds the grid filter row entry. In this example, if 'Range includes the entered values' is not selected, it would search 1891 to 1898.

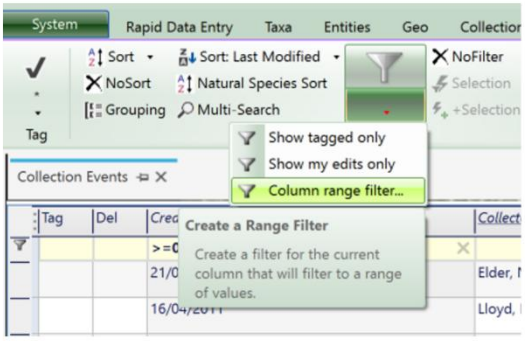
Date filters

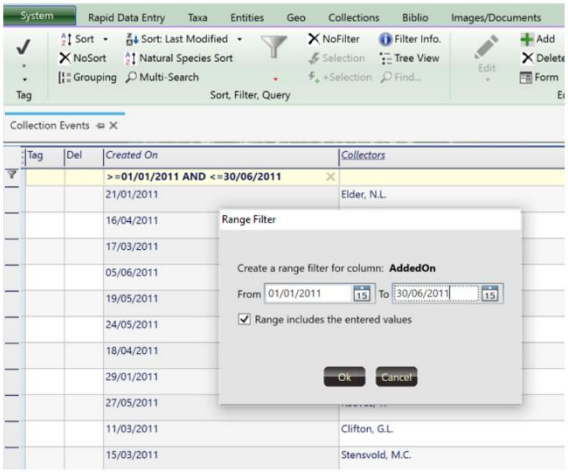
Date filters can be complicated as dates added by BRAHMS also include a time element as shown below:

Species

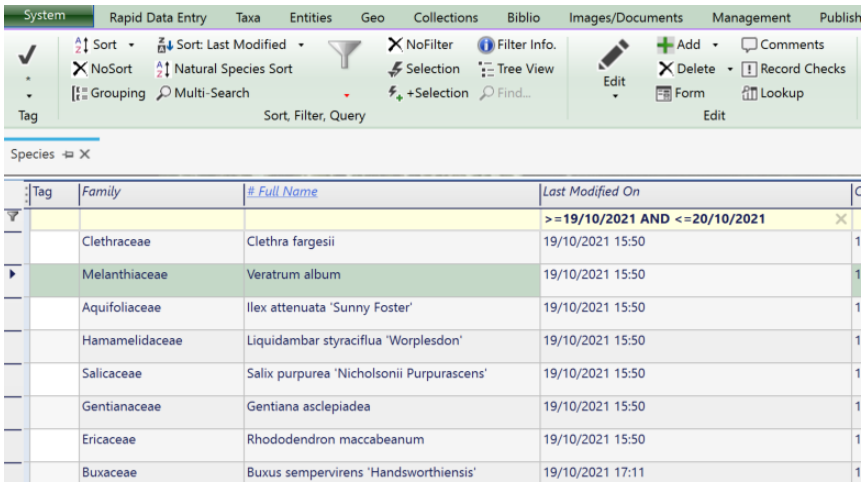
Tag	Family	# Full Name	Last Modified On	Created On
	Clethraceae	Clethra fargesii	19/10/2021 15:50	19/10/2021 1
	Melanthiaceae	Veratrum album	19/10/2021 15:50	19/10/2021 1
	Cupressaceae	Juniperus lucayana Britton	15/07/2021 10:22	

Using the exact 19/10/2021 in the grid filter row will not work because of this time element. You can type in ">= 19/10/2021 AND < 20/10/2021" – but that's pretty tiresome. Thus for date filters, the easiest way is to use the Query drop down '**Column range filter**' option.





The Column Range filter option being used to select a date range. When selecting dates, you can manually type dates in using the above format, or use the date lookup. If 'Range includes the selected values' is not selected, this will exclude the actual values entered – i.e. > 01/01/2011 rather than >= 01/01/2011 etc.



An example date filter applied using a date filter. The time element is ignored.

You can also directly use the grid filter row using commands with syntax:

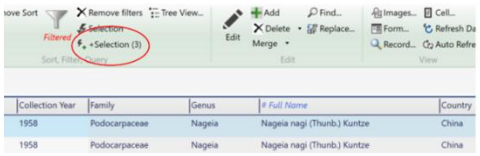
< 1995-01-01 AND <> NULL will filter to any non-null dates before 1 January 1995.
= 1992-04-29 will filter to this exact date but **only** if there is no **time element.**
< 1994-08-30 AND > 1994-08-15 will filter to records lying between these two values.
<= 2015-08-30 AND >= 2015-08-01 will filter to records lying between and including these two values.

Note that AND is in CAPS.

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.



Using the Selection toolbar options.

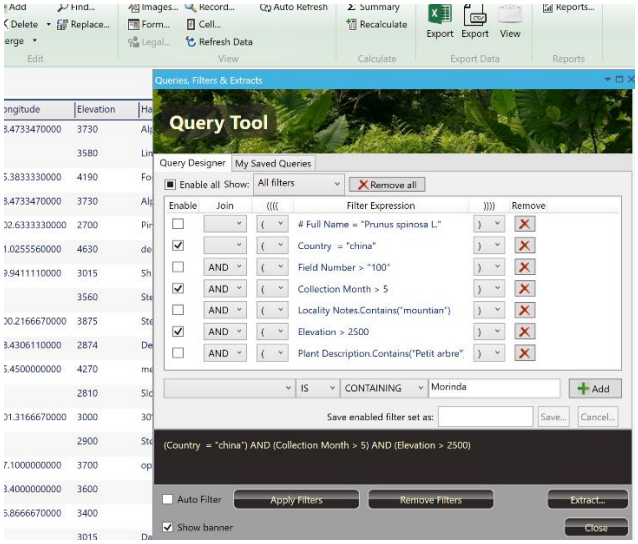
Building and saving more complex queries

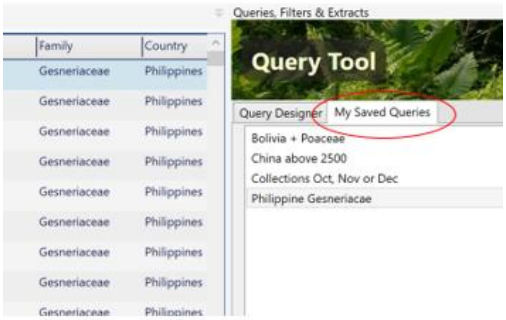
Designing queries

- Select the  toolbar option to open the main **Query** Tool.

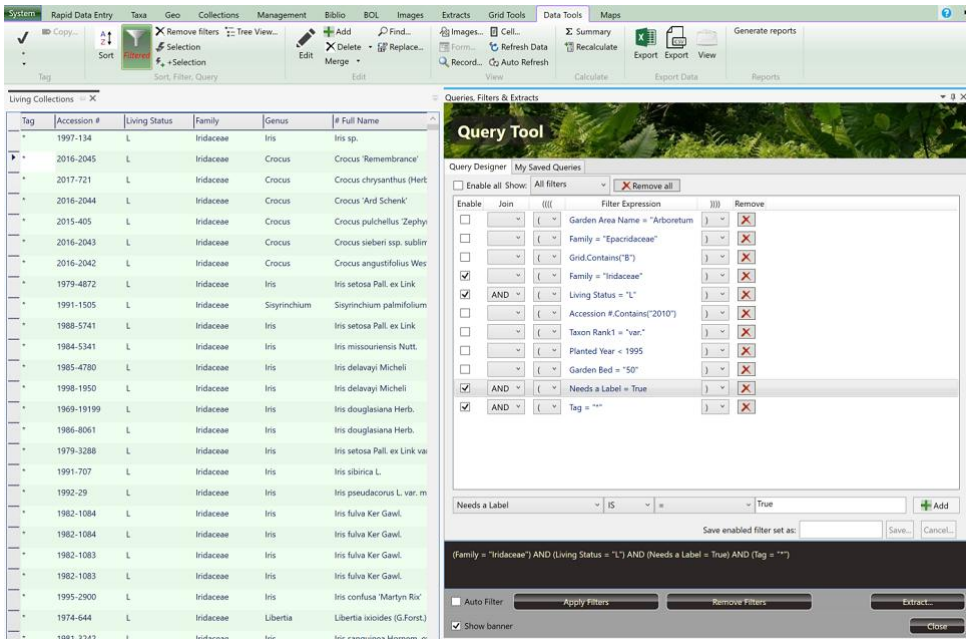
Using the main **Query tool** form, you can design and save your own queries. Queries, which generate visible SQL commands, can mix and match fields of any type. Each command you add is saved unless you remove it from the list. You can then selectively enable and combine the one-line commands and optionally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

- 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.



A further example Query Tool form with previously used commands, three commands enabled.

Saving a query

To save a query, you must provide a name and use the Save option.



Sharing query commands

When you save a query with a given name, you will see the query listed under 'My Saved Queries'. Here you can Share the query by selecting the **Share** tick box. Note that you can opt to show/hide queries submitted by other users.

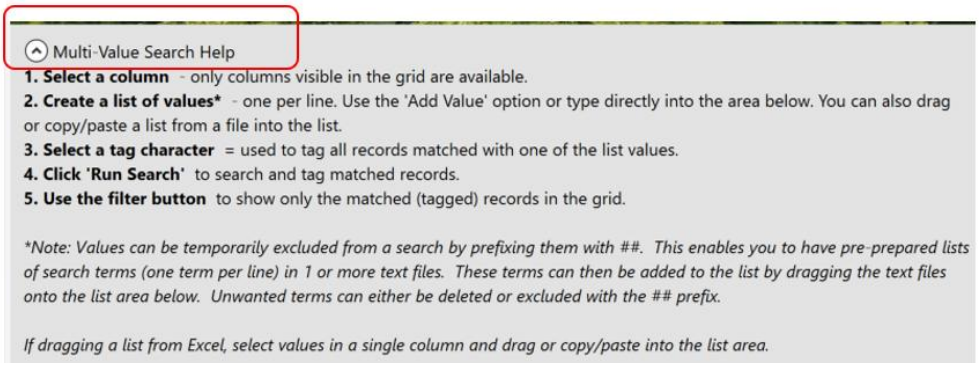


Multi-Value (list) searches

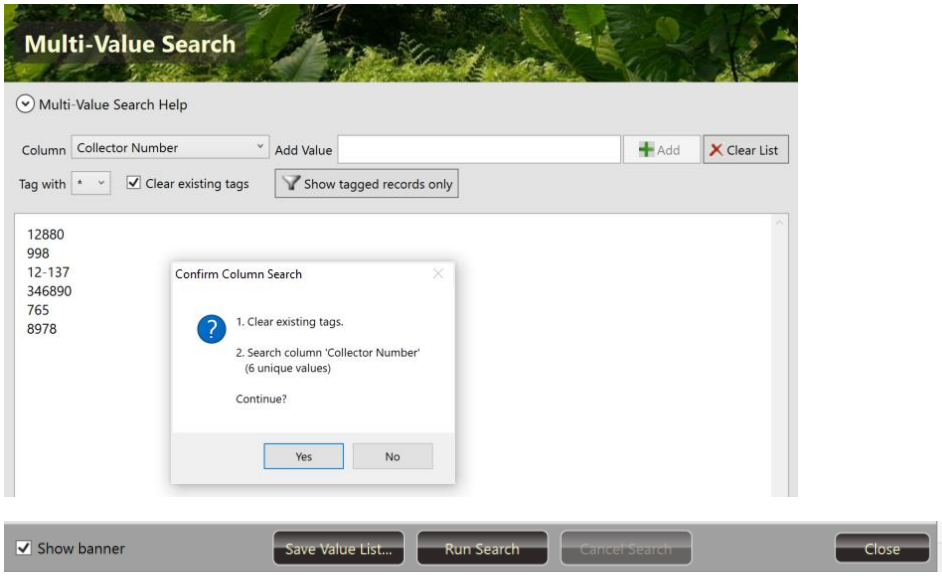


The Multi-Value Search enables you to copy or enter a list of values to locate and tag records in the current table. For example, you may have a list of species names, plant accession IDs, collector numbers, publication years, barcodes or transaction IDs that you wish to locate.

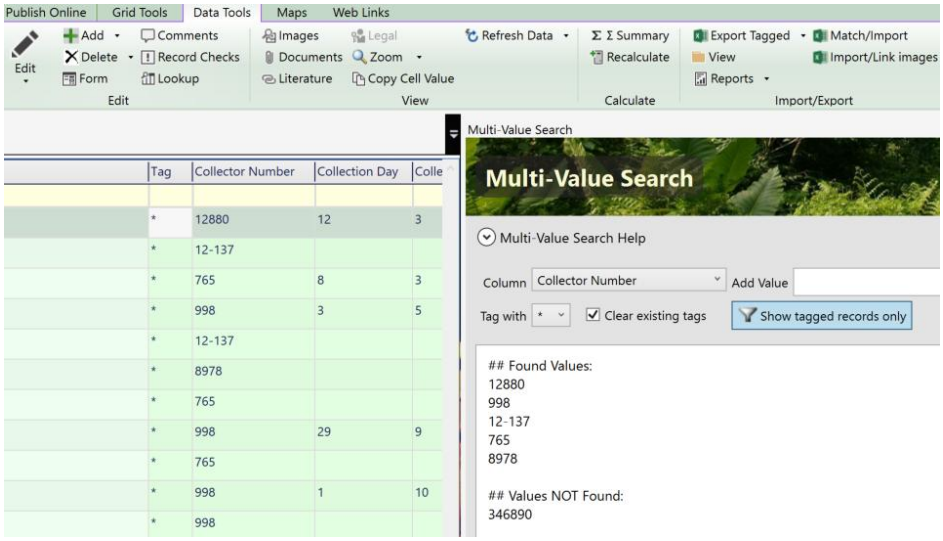
Rather than searching for these one by one, the data items can be manually added to the multi-value search area or pasted in from a list you may have - *e.g.* a list of values in a Word doc or an Excel column. NB. You can use this for barcodes but bear in mind, there is an additional barcode search option on the Collections menu toolbar.



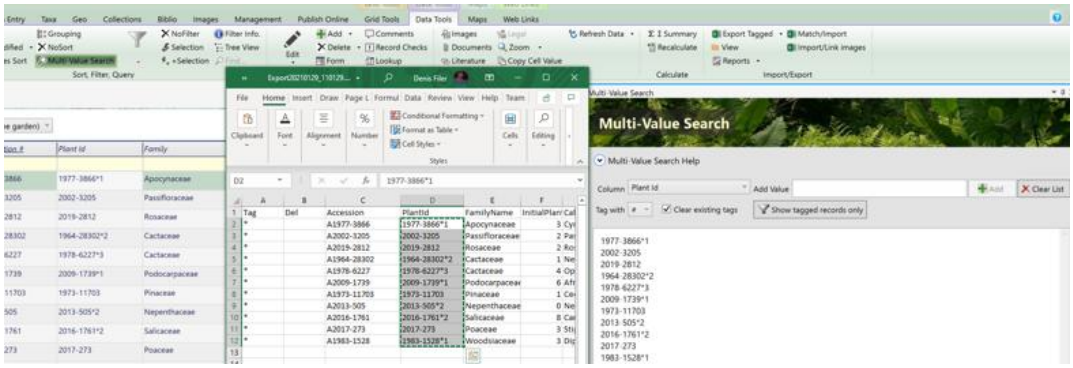
Help is provided when using this option.



Use Run Search to initiate the search, confirming your search as prompted.



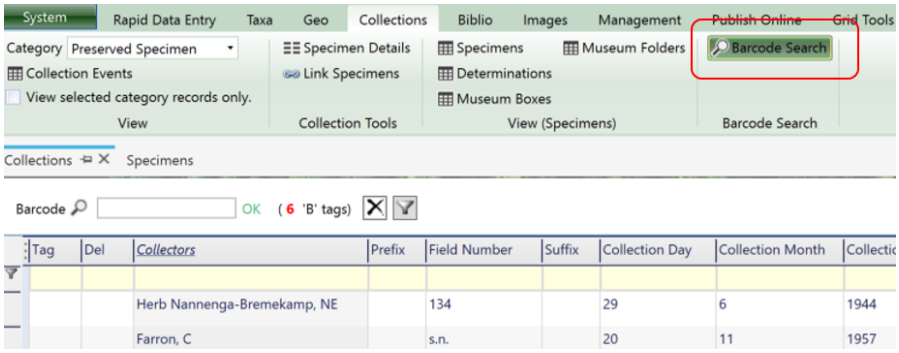
*Search results are summarised with the values found and not found. Found values are tagged. If there is more than one value located, all values are tagged. Use the '*Show Tagged records only*' option to apply a filter on your results. Prefix values with ## to exclude from the search.*



In this example, a list of Plant IDs is copied from an Excel sheet.

Barcode searches

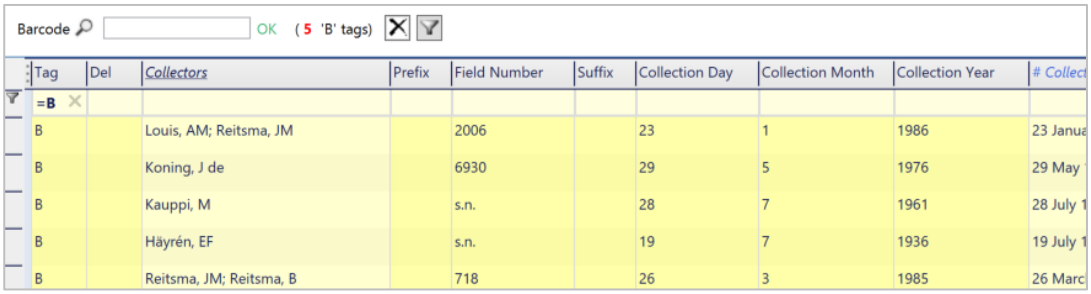
Barcodes can be used to locate records quickly and uniquely. In the main collection event or specimen tables, enable the barcode search toolbar using the **Barcode Search** option on the **Collections** menu.



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.

Barcode searches have a 'Found' and 'Not-Found' beeping noises. Note that your PC sound must be enabled to hear these beeps. Separate beeps may be configured on your actual barcode scanner.

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.

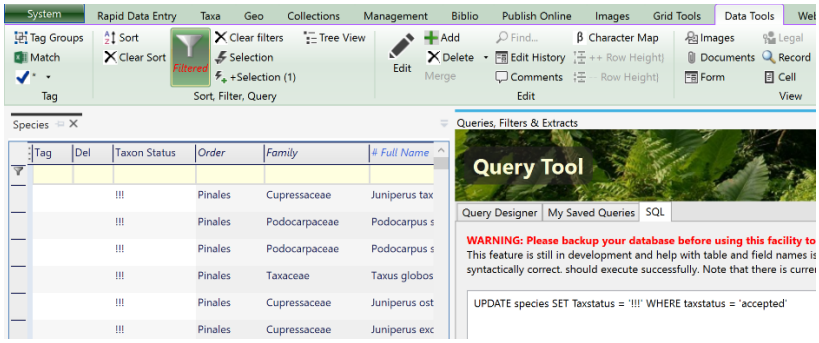
Meanwhile to test the concept and see what's coming:

- 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'

(Note the use of single rather than double quote marks)

- 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.

A more complex example which uses tags follows. This example sets the Boolean field NOTONLINE in the specimens table to True (1) for all tagged records:

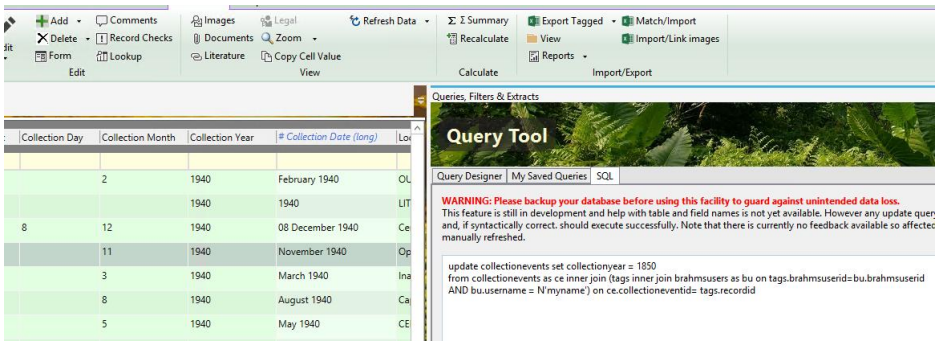
update specimens set notonline = 1 from specimens as sp inner join (tags inner join brahmsusers as bu on tags.brahmsuserid=bu.brahmsuserid AND bu.username = N'*myname*') on sp.specimenid = tags.recordid

In the above example, the username 'myname' must be set to a BRAHMS user log in username. This is because tags are user-specific. The field NOTONLINE can be set to null, 0 (false) or 1 (true). Also be careful when using single quote marks not to use special quotes as generated by Word. Also note that to make the command more readable, the tables can be assigned shorter names. Thus 'specimens as sp' and 'brahmsusers as bu'. This is not necessary but can make complex commands more readable.

By adjusting the table and field to edit, you can use the same command structure elsewhere. Thus:

update collectionevents set collectionyear = 1850 from collectionevents as ce inner join (tags inner join brahmsusers as bu on tags.brahmsuserid=bu.brahmsuserid AND bu.username = N'*myname*') on ce.collectioneventid= tags.recordid

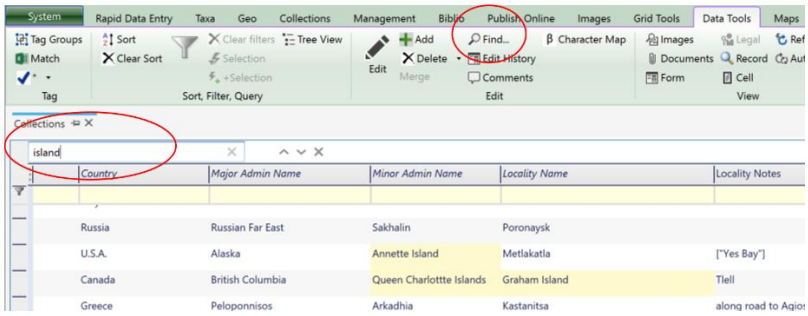
Using the SQL screen, the SQL command can be split up on different lines to make more readable.



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.

Calculated fields

Introduction

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 mostly not auto-updated. Rather you must periodically use the **Recalculation Scripts** option provided on the Management menu to recalculate all or a selection of these fields.

Examples of numeric and string calculated fields are:

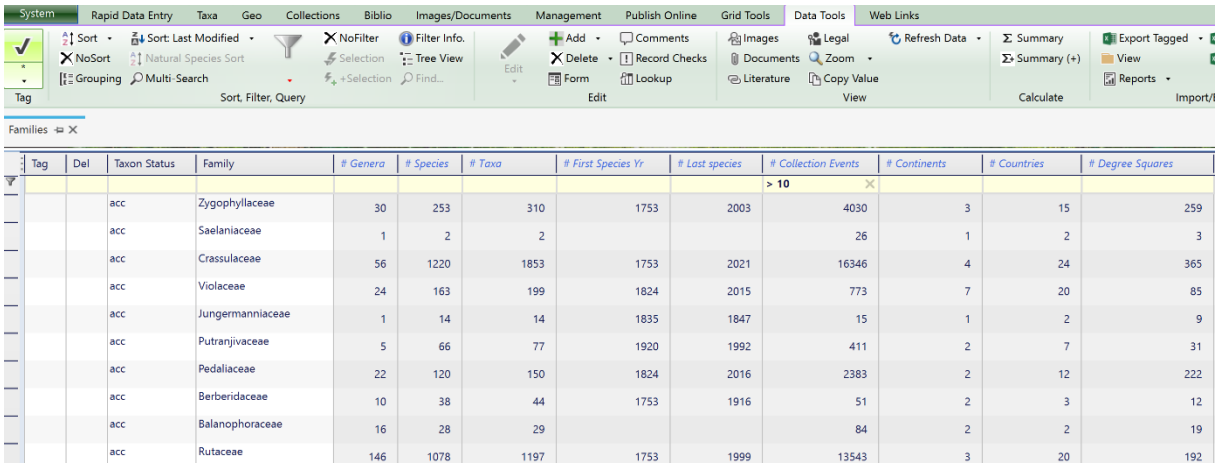
- # collection events per country in the country table
- # images per species in the species table
- # specimens per collection event in the collection event table
- Species full name in the species table added to # Full name
- Text date formats in RDE for specimens
- Gazetteer summaries in RDE for specimens

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 **Data Tools > # Calc Fields**.

Tables can be sorted and filtered using calculated fields and these fields can be included in reports.

Examples of calculated fields



Families

Tag	Del	Taxon Status	Family	# Genera	# Species	# Taxa	# First Species Yr	# Last species	# Collection Events	# Continents	# Countries	# Degree Squares
									> 10			
		acc	Zygophyllaceae	30	253	310	1753	2003	4030	3	15	259
		acc	Saelaniaceae	1	2	2			26	1	2	3
		acc	Crassulaceae	56	1220	1853	1753	2021	16346	4	24	365
		acc	Violaceae	24	163	199	1824	2015	773	7	20	85
		acc	Jungermanniaceae	1	14	14	1835	1847	15	1	2	9
		acc	Putranjivaceae	5	66	77	1920	1992	411	2	7	31
		acc	Pedaliaceae	22	120	150	1824	2016	2383	2	12	222
		acc	Berberidaceae	10	38	44	1753	1916	51	2	3	12
		acc	Balanophoraceae	16	28	29			84	2	2	19
		acc	Rutaceae	146	1078	1197	1753	1999	13543	3	20	192

Some example calc fields in the main Families table.



Countries

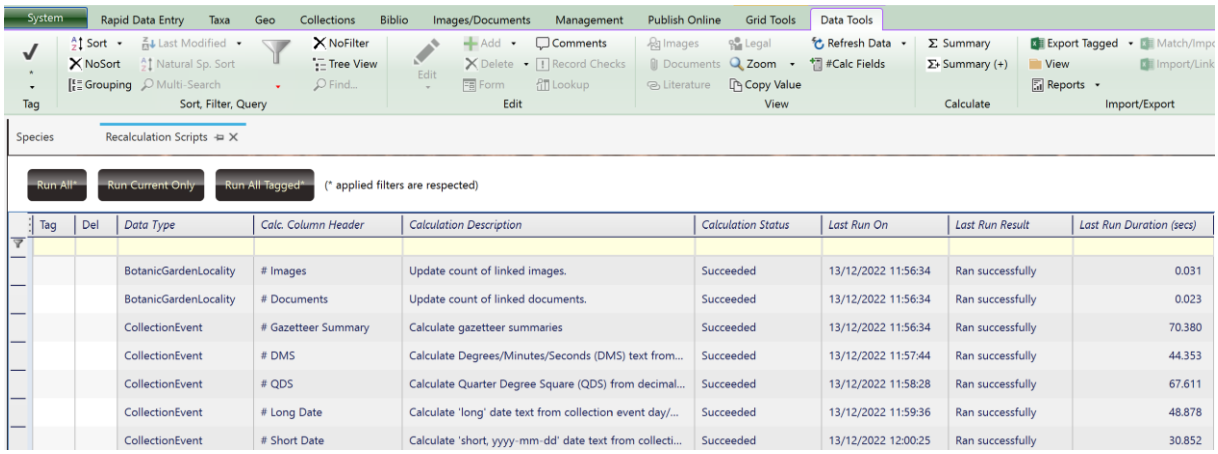
Tag	Del	Country	# Collection Events	# Families	# Genera	# Taxa	# Species	# Localities	# Regions
		Zambia	3748	114	427	1188	1136	217	18
		Nigeria	412	20	124	215	214	3	1
		Mexico	465	13	105	150	150	26	25
		Madagascar	1104	110	315	578	563	8	7
		Malawi	4285	169	645	1668	1588	78	15
		Kenya	3837	116	430	1068	1034	9	5
		Ethiopia	1068	71	243	546	540	6	2
		Zaire [DRC]	3037	87	393	928	909	18	6
		Angola	5729	190	900	2407	2285	734	21
		South Africa	1279395	484	3768	33936	28950	392700	17
		Namibia	72996	223	1322	5954	5344	26431	42

An example of calculated fields in the main country table

Updating calculated fields

Running from BRAHMS

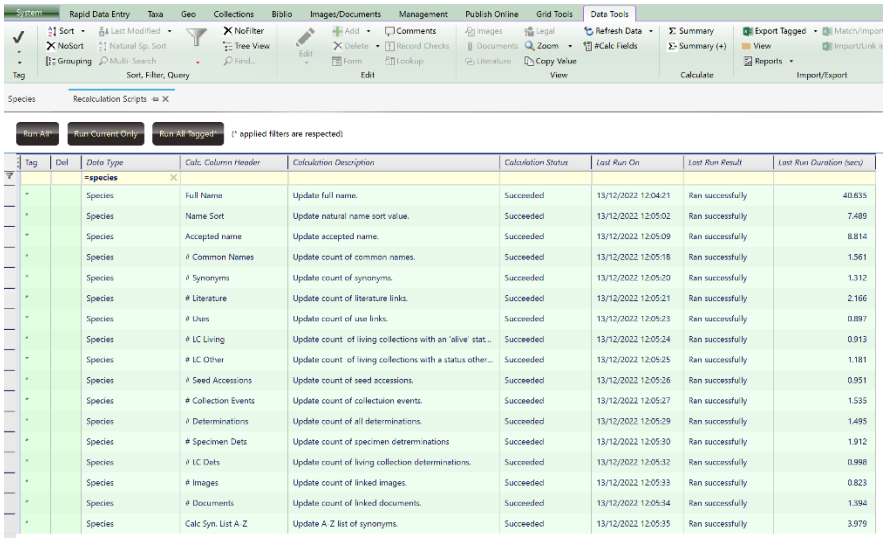
Calculated fields can be updated individually or for the entire database using the options provided under **Management > Recalculation Scripts**. Here, you can see all the calculated field options for the entire database including when the fields were last updated.



Tag	Del	Data Type	Calc. Column Header	Calculation Description	Calculation Status	Last Run On	Last Run Result	Last Run Duration (secs)
		BotanicGardenLocality	# Images	Update count of linked images.	Succeeded	13/12/2022 11:56:34	Ran successfully	0.031
		BotanicGardenLocality	# Documents	Update count of linked documents.	Succeeded	13/12/2022 11:56:34	Ran successfully	0.023
		CollectionEvent	# Gazetteer Summary	Calculate gazetteer summaries	Succeeded	13/12/2022 11:56:34	Ran successfully	70.380
		CollectionEvent	# DMS	Calculate Degrees/Minutes/Seconds (DMS) text from...	Succeeded	13/12/2022 11:57:44	Ran successfully	44.353
		CollectionEvent	# QDS	Calculate Quarter Degree Square (QDS) from decimal...	Succeeded	13/12/2022 11:58:28	Ran successfully	67.611
		CollectionEvent	# Long Date	Calculate 'long' date text from collection event day/...	Succeeded	13/12/2022 11:59:36	Ran successfully	48.878
		CollectionEvent	# Short Date	Calculate 'short, yyyy-mm-dd' date text from collecti...	Succeeded	13/12/2022 12:00:25	Ran successfully	30.852

An example data grid showing a few of the recalculation fields

You can apply filters on this data grid to see only those fields in one or a selection of tables.



Tag	Del	Data Type	Calc. Column Header	Calculation Description	Calculation Status	Last Run On	Last Run Result	Last Run Duration (secs)
		=species						
		Species	Full Name	Update full name.	Succeeded	13/12/2022 12:04:21	Ran successfully	40.635
		Species	Name Sort	Update natural name sort value.	Succeeded	13/12/2022 12:05:02	Ran successfully	7.489
		Species	Accepted name	Update accepted name.	Succeeded	13/12/2022 12:05:09	Ran successfully	8.814
		Species	# Common Names	Update count of common names.	Succeeded	13/12/2022 12:05:18	Ran successfully	1.561
		Species	# Synonyms	Update count of synonyms.	Succeeded	13/12/2022 12:05:20	Ran successfully	1.312
		Species	# Literature	Update count of literature links.	Succeeded	13/12/2022 12:05:21	Ran successfully	2.166
		Species	# Uses	Update count of use links.	Succeeded	13/12/2022 12:05:23	Ran successfully	0.897
		Species	# LC Living	Update count of living collections with an 'alive' stat...	Succeeded	13/12/2022 12:05:24	Ran successfully	0.913
		Species	# LC Other	Update count of living collections with a status other...	Succeeded	13/12/2022 12:05:25	Ran successfully	1.181
		Species	# Seed Accessions	Update count of seed accessions.	Succeeded	13/12/2022 12:05:26	Ran successfully	0.951
		Species	# Collection Events	Update count of collection events.	Succeeded	13/12/2022 12:05:27	Ran successfully	1.535
		Species	# Determinations	Update count of all determinations.	Succeeded	13/12/2022 12:05:29	Ran successfully	1.495
		Species	# Specimen Dets	Update count of specimen determinations	Succeeded	13/12/2022 12:05:30	Ran successfully	1.912
		Species	# LC Dets	Update count of living collection determinations.	Succeeded	13/12/2022 12:05:32	Ran successfully	0.998
		Species	# Images	Update count of linked images.	Succeeded	13/12/2022 12:05:33	Ran successfully	0.823
		Species	# Documents	Update count of linked documents.	Succeeded	13/12/2022 12:05:34	Ran successfully	1.394
		Species	Calc Syn. List A-Z	Update A-Z list of synonyms.	Succeeded	13/12/2022 12:05:35	Ran successfully	3.979

Recalculation fields for the main species table

Updating using a Scheduled Windows Task

You can set up a scheduled Windows Task to update all BRAHMS calculated fields by executing the command line:

brahms.exe -recalc

You could set this up as an automated scheduled task on your server using the Task Scheduler, thus ensuring your calculated fields are up to date.

Typically, such a scheduled task would be run on the server where the database is stored. In this case, you need to copy the BRAHMS software folder to the server. However, you could run the task on your own local PC at a scheduled time – assuming your PC was powered up at that time.

NB. This will only work on those data connections that have been shared to the application's Shared folder where you are running brahms.exe from. Shared connections will exist in the shared folder as .dat files. For help on sharing connections, refer to the section on **Data Connections > Sharing data connections**.

When you run brahms.exe – recalc, there is no immediate feedback. However, you can see the calculations being auto-updated if you open **Management > Recalculation Scripts** and watch the 'Last Run On' field or see it running in your Task Manager.

Adding calculated fields to reports

This separate topic is discussed in the reports section of this guide.

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 auto-saved 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.

About saving data

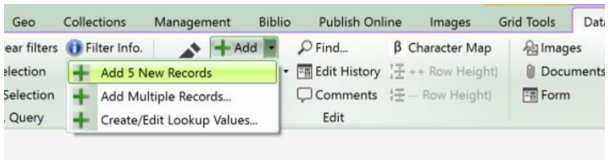
When editing data directly in data grids you must be in Edit mode. A pencil icon appears in the data grid left margin. Data are saved as follows:

a) Pressing Enter to move to next field (NB TAB moves to next field but does not save).
b) Moving to a new record.
c) Going out of Edit mode.
d) Closing the table will force save any unsaved edits.

Note. TAB does not save data as this key is using frequently to move to next field. Each save saves the entire record has an associated 'cost'. Thus, as a rule, it is inefficient to save for each field change.

Adding records

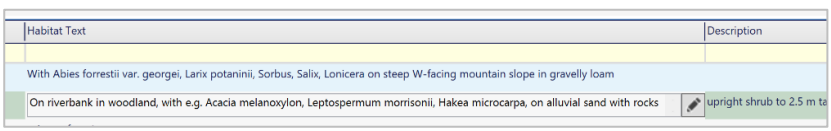
New records are added using the **Add** option on the Data Tools toolbar. You can add a single blank record – or add new records in batches as offered on the Add drop-down. Each new record is assigned a GUID primary key (not visible unless selected). Adding batch records is especially handy in RDE –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



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

Editing larger text fields

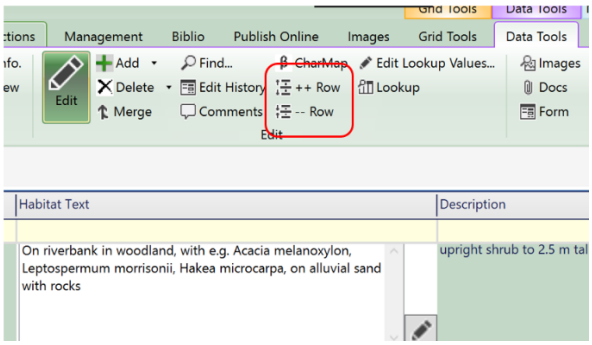
Larger text fields (known as memo fields in v7) can be edited in the data grid itself or, by clicking on the field edit icon, in a separate text editor window.



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.



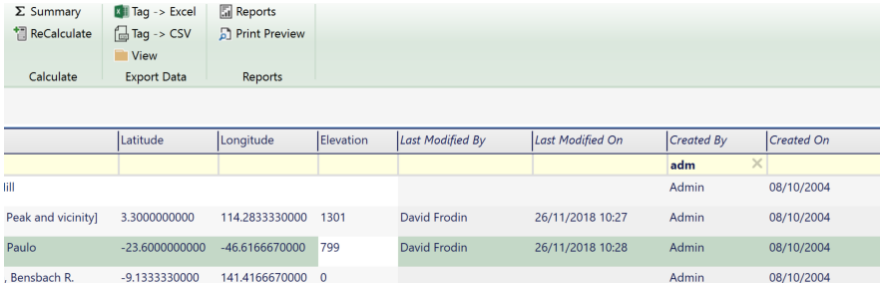
You can also increase row height to edit large text fields in the data grid without opening a separate text editor.

What cannot be edited?

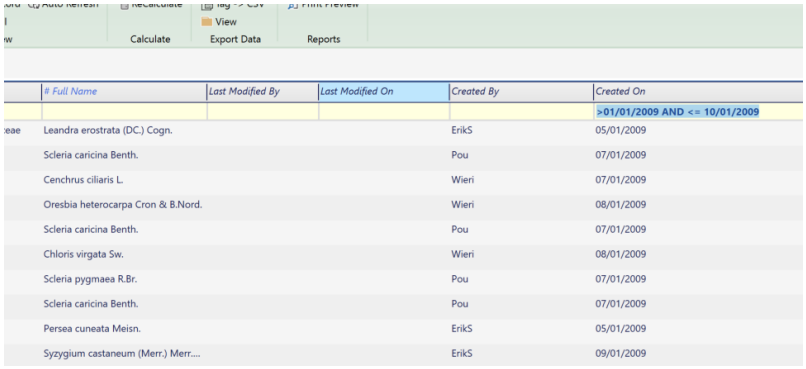
Some fields in data grid and forms cannot be edited. Mostly, these will be fields that are visible but belong to another table. In some cases, these fields will have specific lookup functions, an example is the species #Full Name field in collection and accession files. But in other cases, data from 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

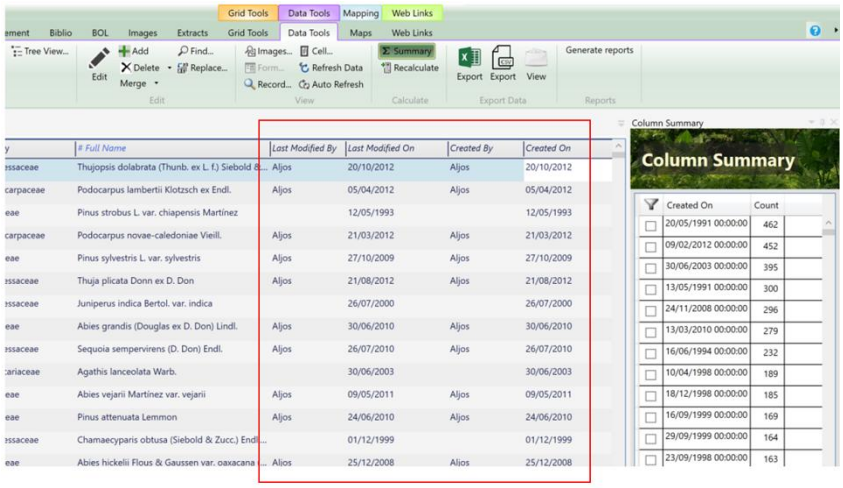
When new records are added the audit fields *Created By* and *Created On* are filled. When a record is edited in any field the fields *Last Modified By* and *Last Modified On* are updated. These fields cannot be edited but can be used to apply filters and sorts.



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.



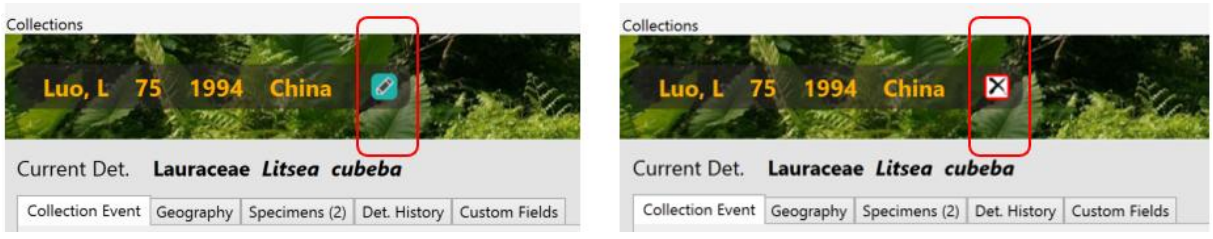
Viewing add/edit dates and name of person adding/editing in the main species file. You can sort on any of these columns and also use the Summary tool as shown here for the created-on date field.

Data forms

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

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.

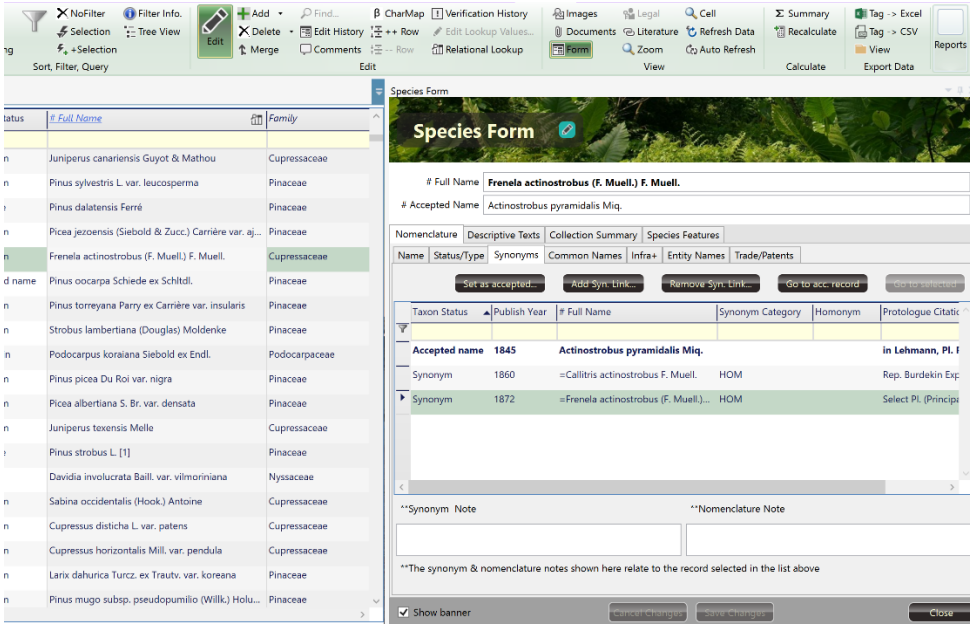
In order to edit data on forms, you need to be in Edit mode. If you are not, data will not be saved and lookup options are not enabled.



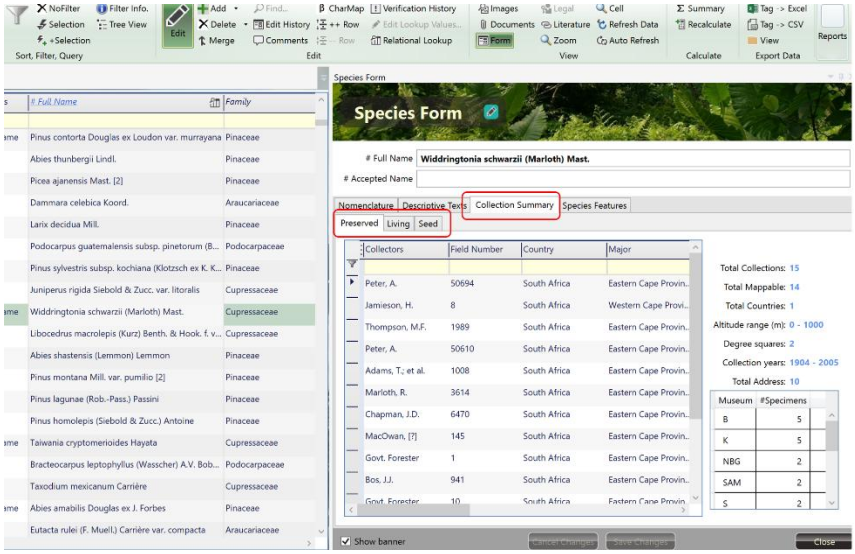
The form icon indicates if you are in Edit mode or not.

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.



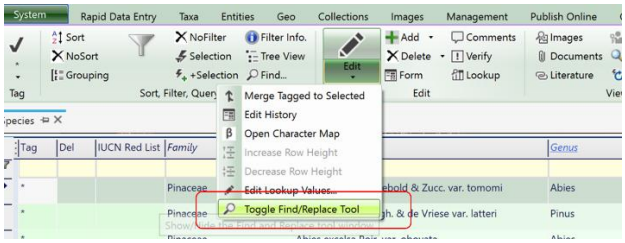
Data can be viewed and edited using grids or forms. Forms can be resized, docked or dragged to separate monitors.



Summary of collections on the main species form.

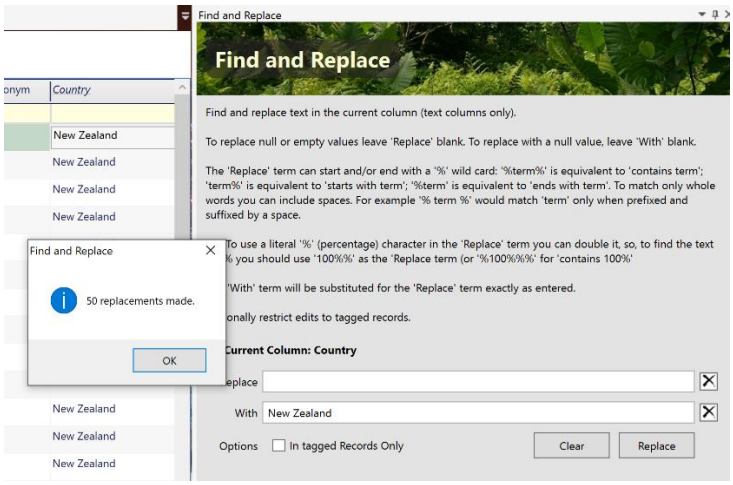
Find and Replace

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



The Find and Replace tool.

Find replace actions can be restricted to tagged records. They also respect your current filter settings. Thus if you have a filter on a family name, only records in that family would be edited. Find replace edits are recorded in the Edit History table.



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:
    - '%term%' is equivalent to 'contains term';
    - 'term%' is equivalent to 'starts with term';
    - '%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%%%' for 'contains 100%'

Deleting records

Marking records for deletion

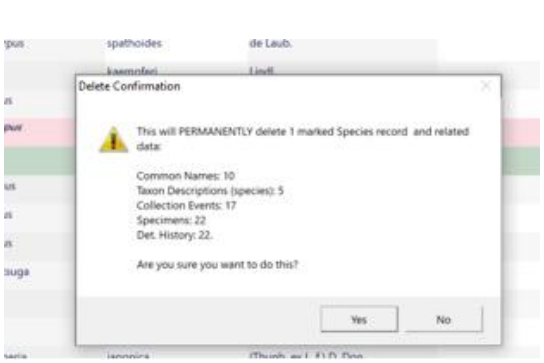
Records are first marked for deletion using the **Delete** option on the **Data Tools** toolbar or the default **F7** key. This adds * to the DEL field and displays the record in a strikeout font. Repeating the action for a record marked for deletion will un-delete it. You can manually add * to the DEL 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.

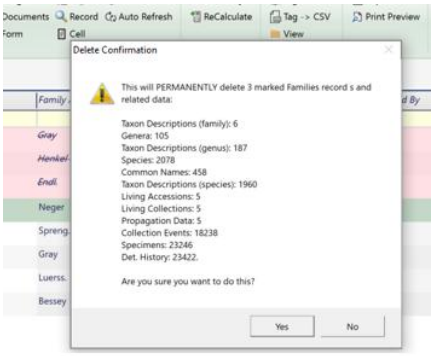
Removing records marked for deletion

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.



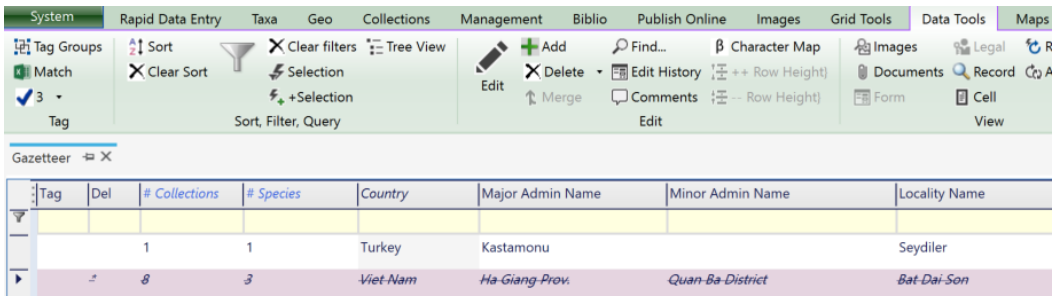
*The species table with several records marked for deletion. To finally remove these records, select **Delete > Remove records marked for deletion**. This leads to a message box that lists the consequences of deletion. As a rule, deletion of a record leads to the deletion of all its child records.*



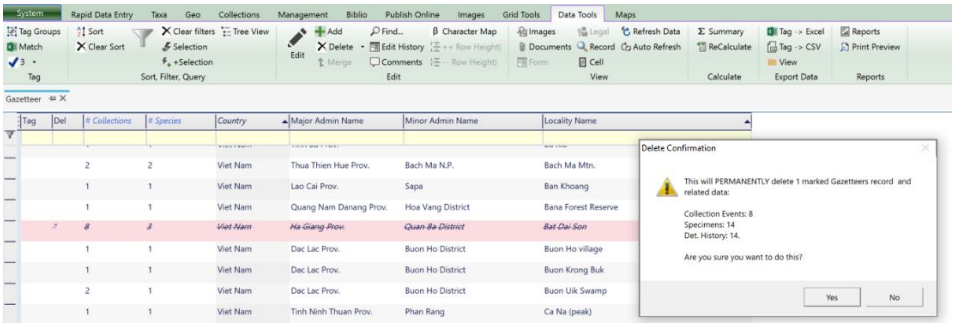


In the above examples, the deletion of the species or the families would also delete the records listed in the message boxes. The deletion of three accepted family names in the demo conifer database would lead to the deletion of all the records as reported

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.

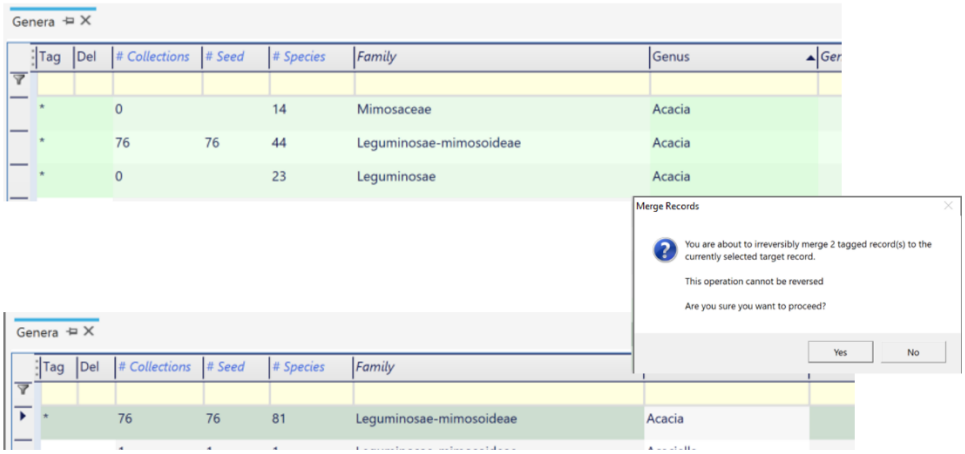
The **Merge to Selected** option, in this case will make both spellings the same (Alpes Maritimes). Records themselves are not merged. The option can be used to merge many values at the same time. The currently selected record is deemed to be correct value.

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).



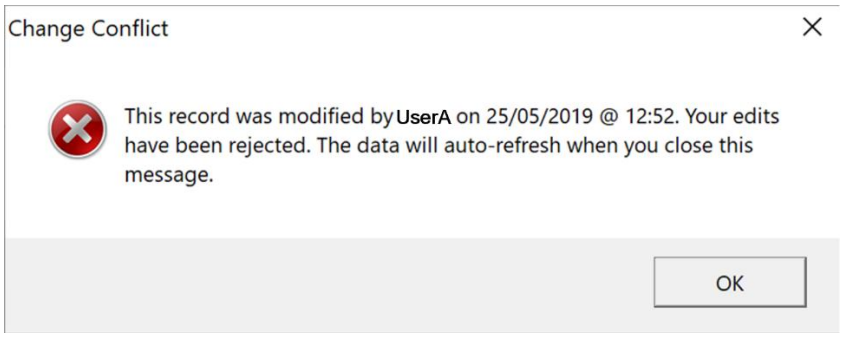
The genus Acacia, added 3 times under three families are merged to a single entry under the selected family.

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 us 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.



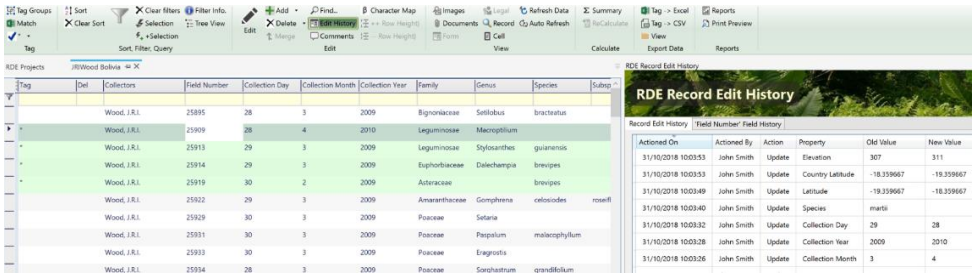
In the event of an edit conflict, the system issues a warning as above.

Track and reverse changes

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

Introduction

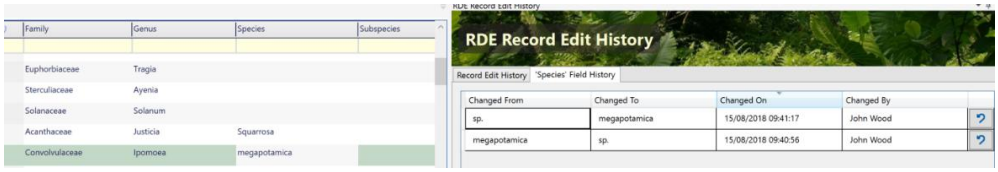
All database changes, including those made in RDE files, are tracked in an *edit history* table. This feature tracks all record editing; who made the changes and when, together with the original and edited values. All changes, including those in long text strings, can be reversed using the **Undo** option.



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

Field level changes and undo

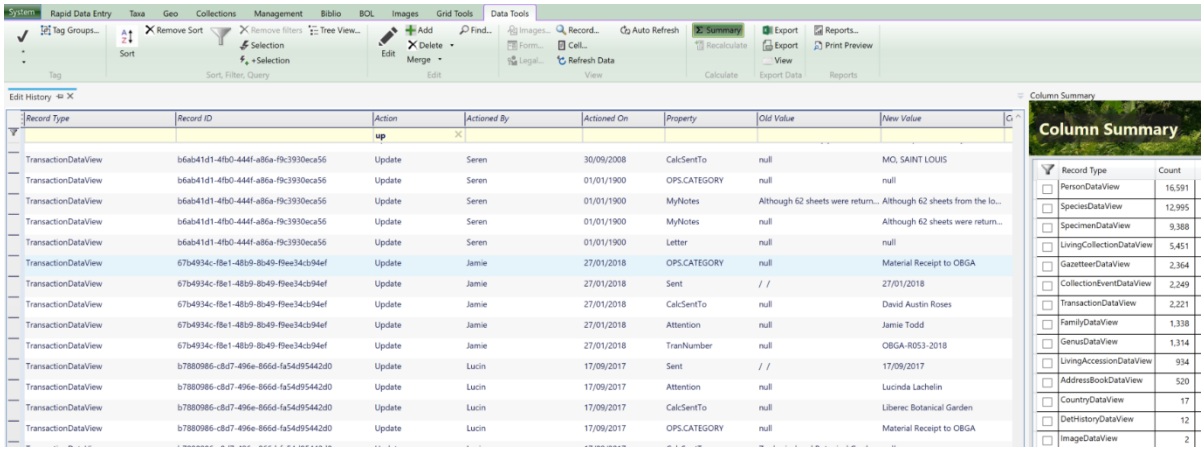
The Edit History Form Field level tab lists the edits made to the current field. Here, you can use the Undo option to reverse edits – opting to go back as many stages as you have recorded.



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.

Edit History Archiving

The Edit History table can be archived using **System > Options > Management > Archive EditHistory** tool. This leaves a selected time period active, the remainder going to a new Edit History archive table. The archive can be partially or fully restored. The Edit History table is by far the largest table in most systems and having access to your entire edit history is not always required.

Record checks and data verification

Introduction

For users with permission to do so, data records can be marked up as checked/verified. This function can be used for all records in any table. An example would to mark a collection event as “Map Checked” or a species as “Name Verified”. The actual check categories you use are selected by your project and can be registered in a lookup list.

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. You can also review all checks registered across your database.

Providing permission to edit status codes

Users must have permission to add or edit verifications. This setting is found on the main Permissions form opened by selecting **System > Manage Users and Permissions > Specific Actions > Editing Tools** and ensure the settings are applied appropriately for the selected user.

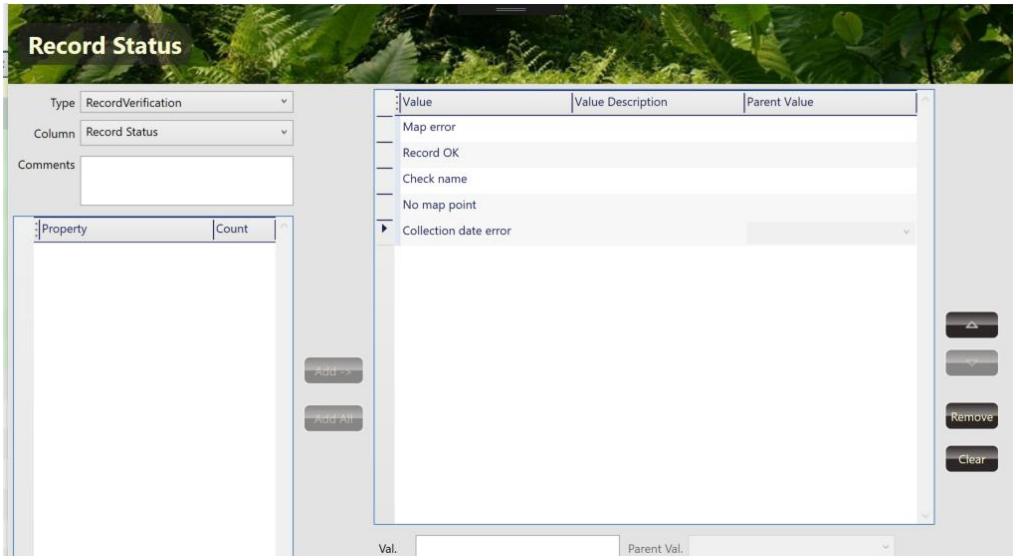


Setting permissions for record verification on the permissions form

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.

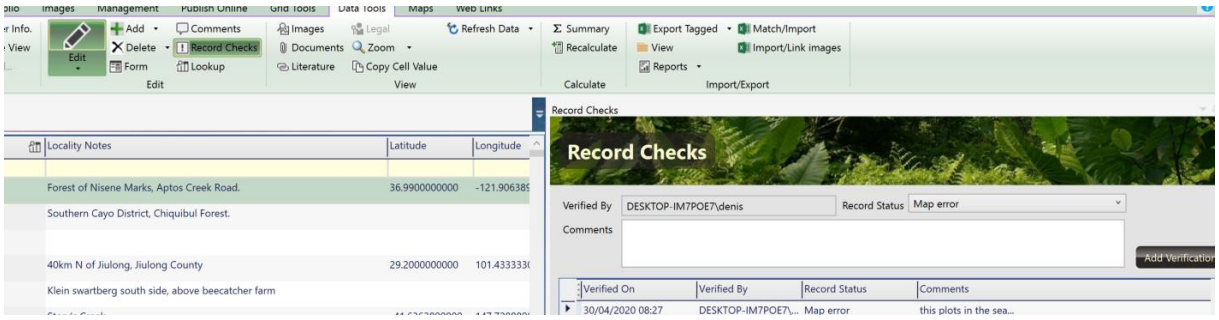
You can add as many status options as you like. To add or edit these, select **Management > Lookup lists**. Entries must be added here with the Field Name set to RecordStatus (case sensitive).



Adding some Record Status values to the lookup list.

Adding and deleting verification records

In any open table, open the verification tool using the **Record Checks** 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.

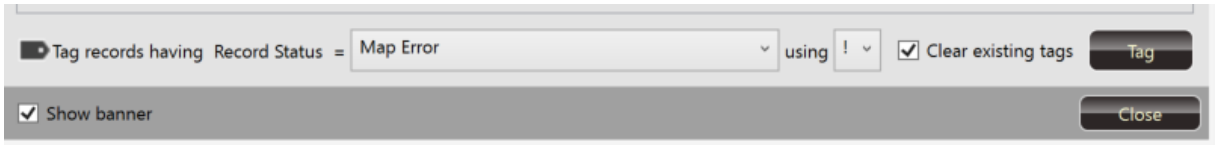


A given record may have multiple verification records. Records are sorted with the most recent at the top of the list.

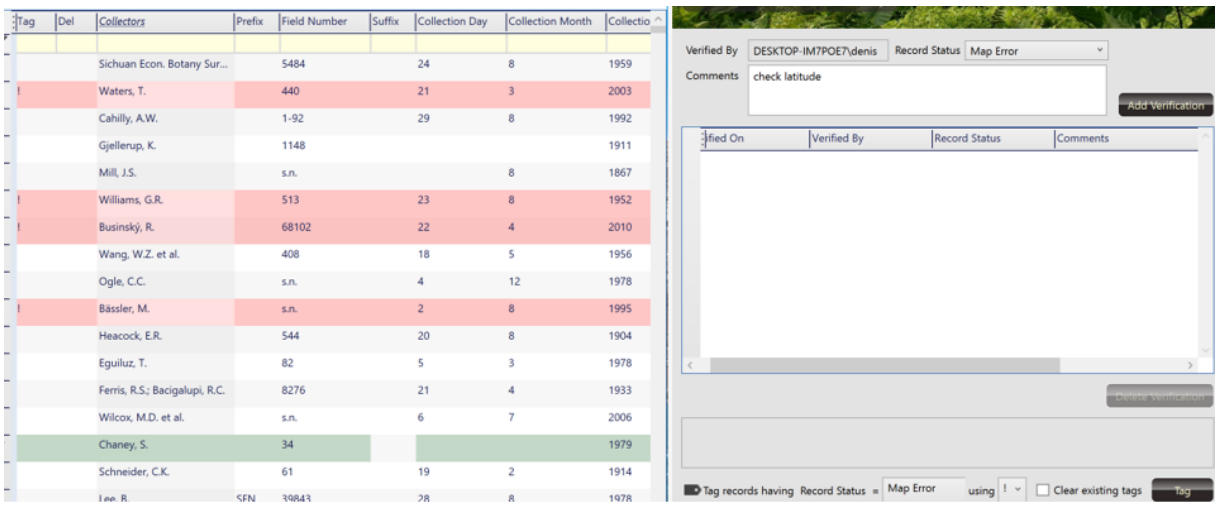
Reviewing verifications

The verification history for individual records can be seen by opening the Record Checks 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 Record Checks 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.

View all Record Checks

A data grid (**Management > Record Checks**) is available to display all Record Checks across your database system. As well as filtering on this table, you can transfer tags from this table to the source records using the **'V' tag -> Source** option as provided. For example, you may want to tag all collection events that have had their map data checked during the past 3 months.

Match/Update data – Excel to BRAHMS

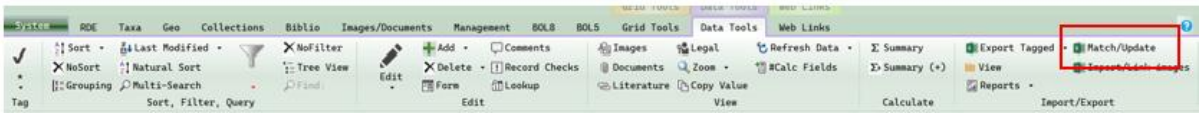
Match/Update introduced

The **Match/Update** 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:

a) tag records in BRAHMS that match those in the XLSX file.
b) transfer selected columns from the xlsx file into BRAHMS based on your match criteria.

Please note: this option CANNOT be used to add new records to any table, only to update existing records. To add new records, check the Rapid Data Entry (RDE) functions and/or add data manually.

Also, see below section on matching across tables - if you are matching data using a match field from another table (*e.g.* using specimen barcode to update collection events)



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

Note: you can also use the BRAHMS Multi-Search tool to tag records that match a list of data values - for example a list of barcodes.

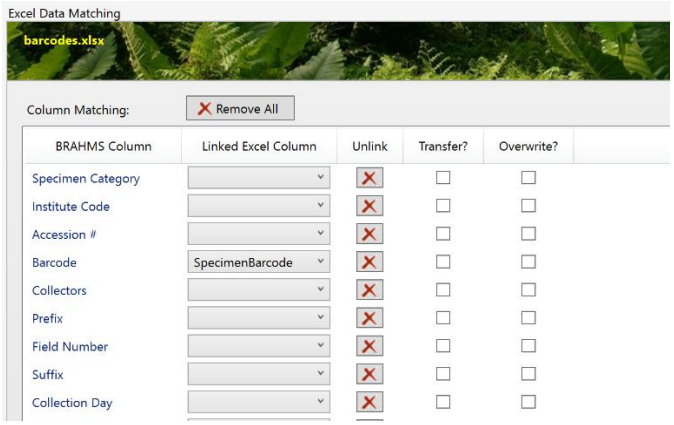
If you have an Excel .xlsx file and you want to know which records in this file also occur in the opened BRAHMS table, you can use the matching tool. Matching allows you to choose the fields to match on. In some cases, there may be an obvious field to match on – for example a barcode (given that barcodes 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 + Collector 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.

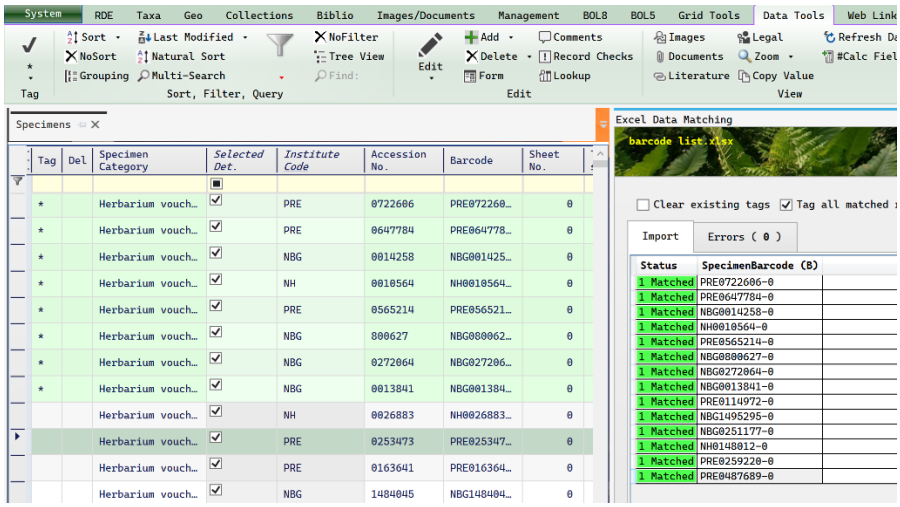
A worked example of matching – specimen table

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 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 in 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.



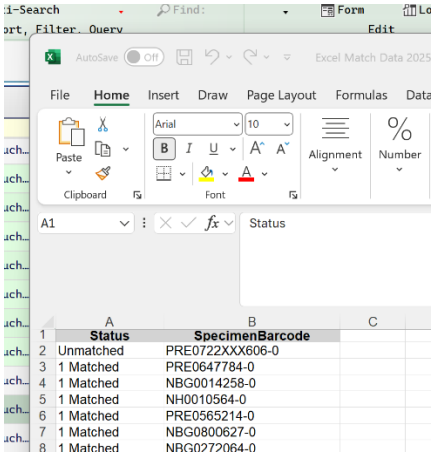
After selecting Match Excel to your data, the match success is reported. The number of matches is also reported. The matched records in your database table will now be tagged if this option is selected.



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).

Unmatched entries

If the Excel table includes records that cannot be matched, these unmatched records are marked and you can export your match results to a further Excel reporting table.



*Use the **Export** option on the Match/Update form to create a match data report.*

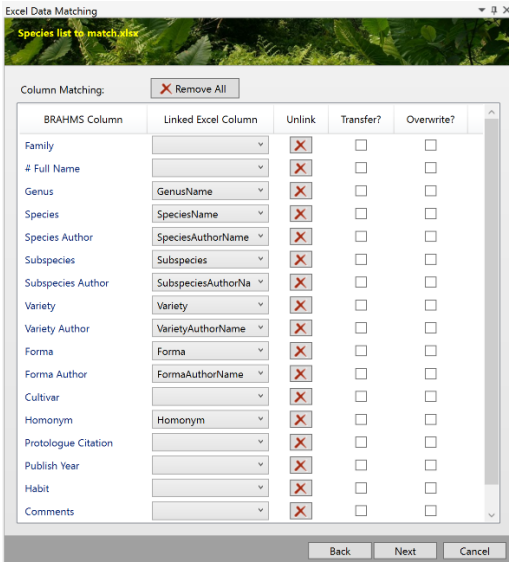
A worked example of matching – species table

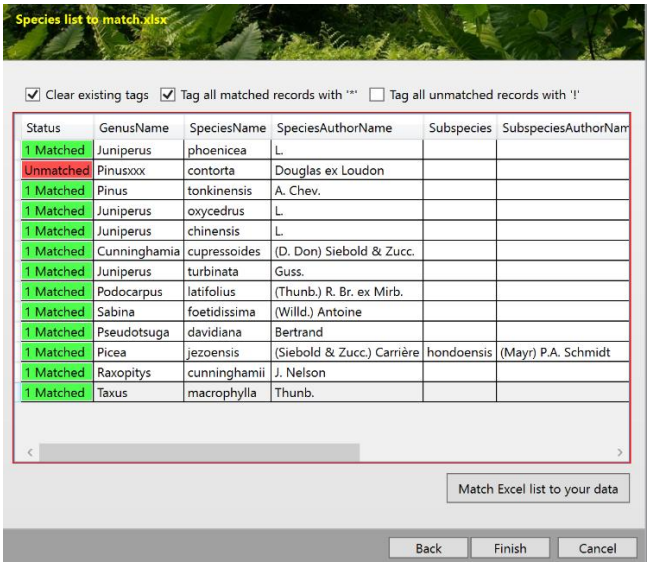
If you do not have an obvious, single match field such as barcode, you can choose those fields that you consider will give the best match. In the below sample, records in the main species table are matched using multiple fields Genus, Species, Species Author, Subspecies and Subspecies Author, Variety,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



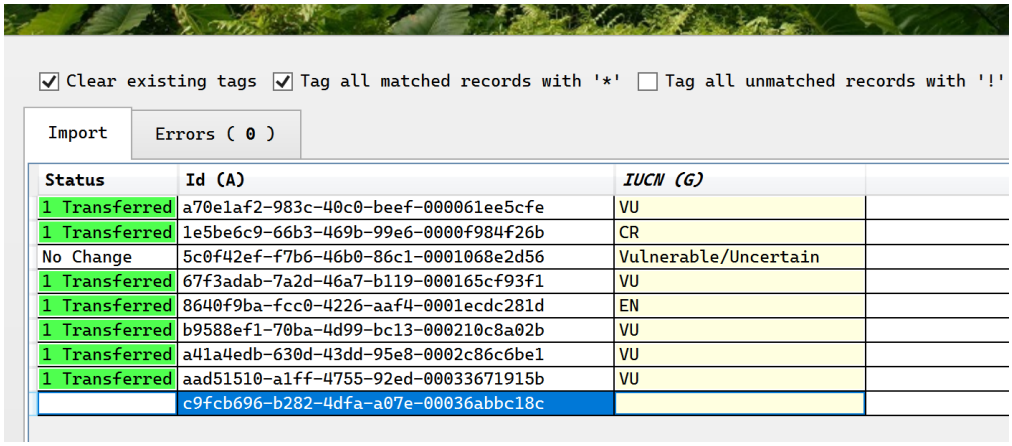
One record has been edited to force a non-match between this Excel file and the database.





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.

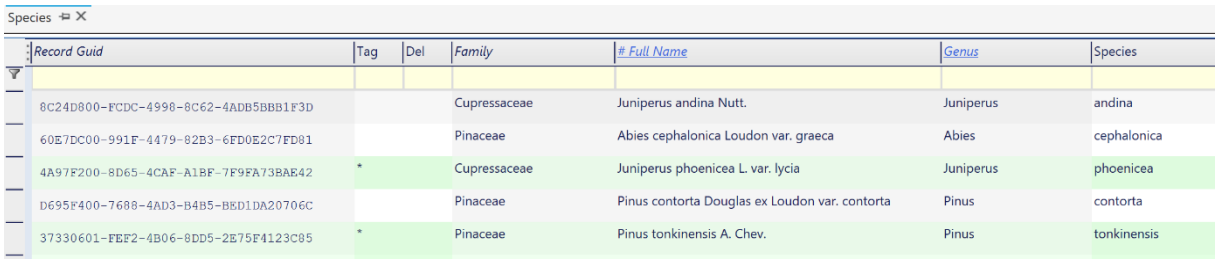
Reporting errors



In this example, the IUCN entry exceeds the 10 character limit for that field. It cannot be updated.

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.

Matching across tables

You may need to update data in a table where your Excel file only has a matching field from a related table. A good example of this is updating fields in your Collections Events table based on specimen barcodes. The

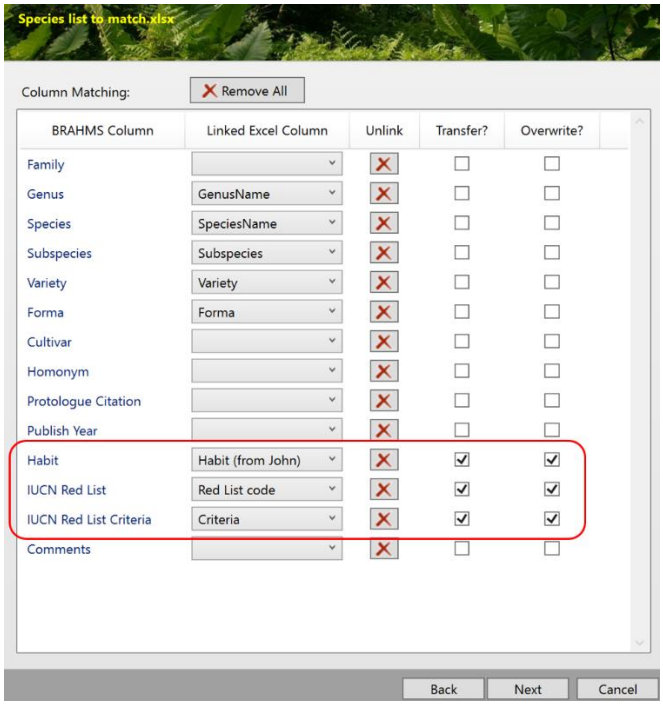
specimen barcode is not in the Collection Event table itself and thus cannot be used directly for matching. The approach here is as follows (this example applies to the collection event/specimen tables):

a) Open the specimen table and ensure both the Collection Event GUID and Barcode fields are visible.
b) Export these two columns to Excel for tagged records.
c) The next step is to add the Collection Event GUID to the excel table with the data you wish to transfer to Collection Events. As this table has the barcode, you can use the Excel VLOOKUP() function or another Excel merge method as suits) to add the Collection Event GUID to your data transfer Excel table. VLOOKUP is not further discussed here but there is plenty of help available online.
d) Once this step is completed, you can match import the data to collection events using the Collection Event GUID to match.

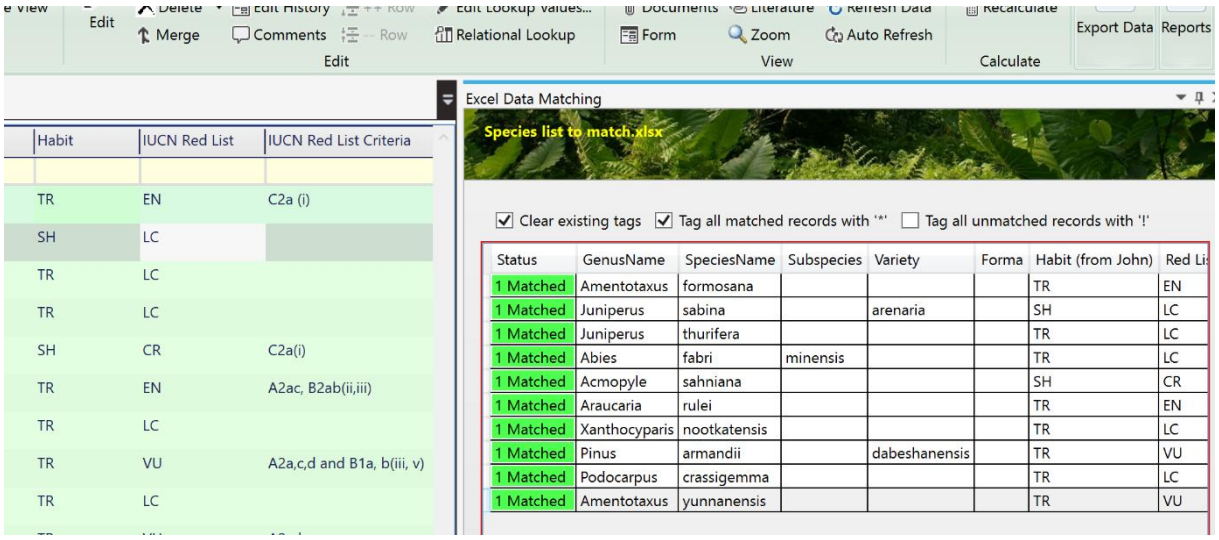
Transferring data

As well as matching records, 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 blank/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.

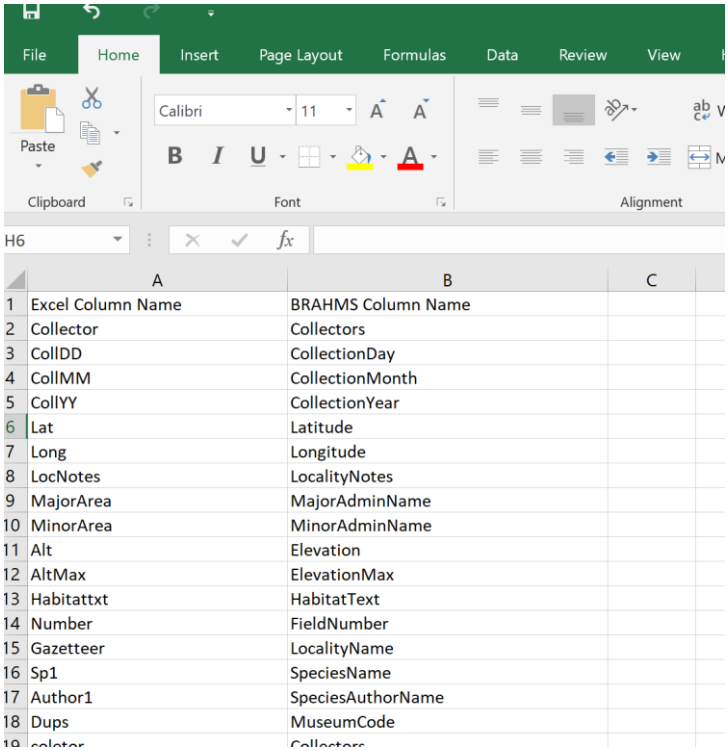
Excel to BRAHMS field matching

When importing data from Excel, for example into an RDE file or when using the Match/Update 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.

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.

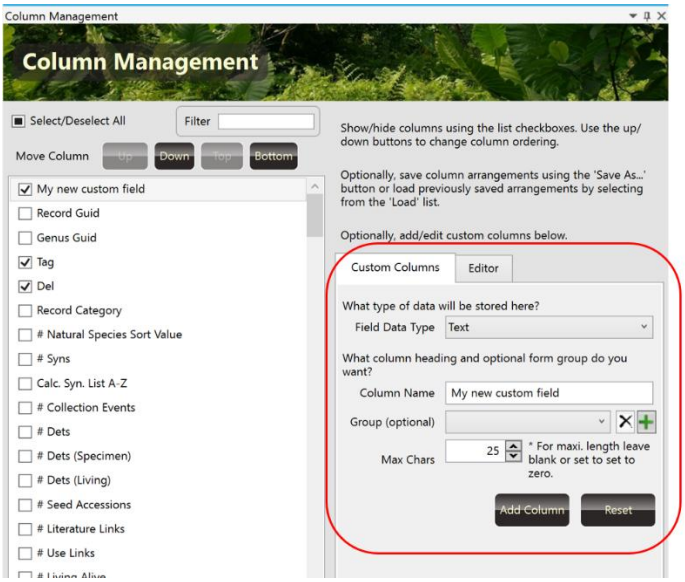
Custom fields and database migrations

Often, when databases are migrated into BRAHMS from other formats, the migration leads to a number of custom fields. These fields may subsequently be deleted if you find the data are not needed – or alternatively, they may be moved to a standard BRAHMS storage field if one is available.

Adding 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.

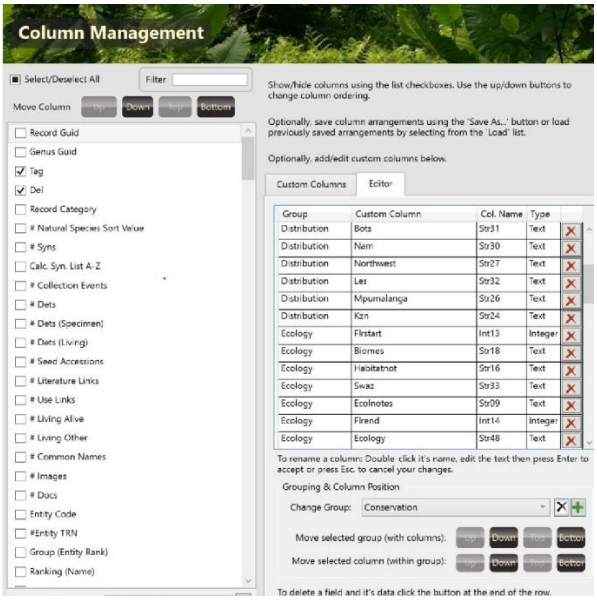


Adding a new field for text storage, max size set to 25 characters.

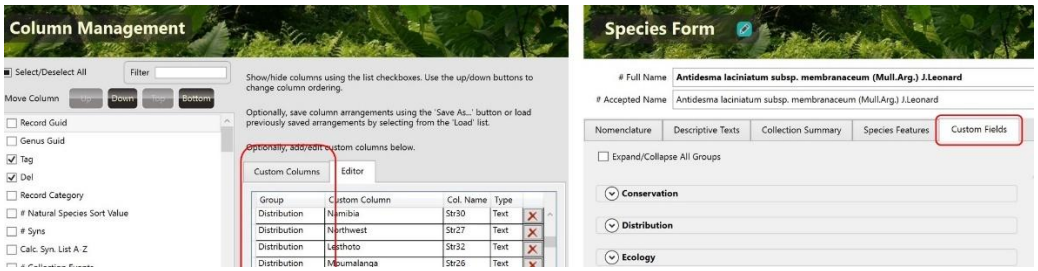
When adding new fields, you can assign the field to a group – as discussed below.

Editing custom fields and assigning groups

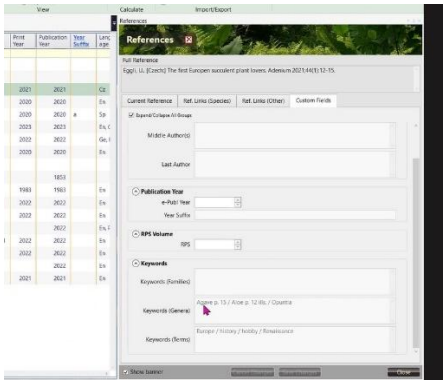
Custom fields can be edited and/or deleted from the Column Manager Editor tab. Here, all custom fields for the current table are listed You can edit the field names by double-clicking on the field name then editing it. You can also assign a field to a named group. The sort order of custom field groups and the fields within them can be adjusted. When viewing or editing data using a form, your custom fields will be presented within your assigned groups.



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



An example of custom field grouping in species table



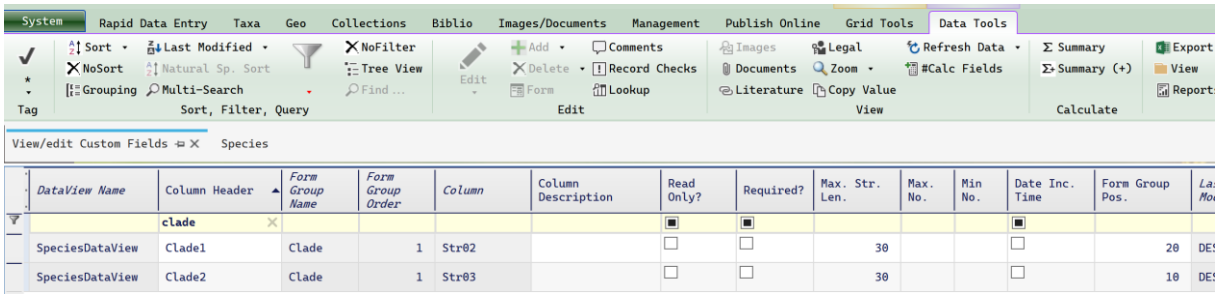
An example of custom field grouping in the literature table

Custom field names

You can assign any name to your custom field headers – for example they may include spaces and be cased as in 'My New Field'. However, in BRAHMS itself, these fields are given a different table storage name such as Str01, Str02, Int01, Bool01, Date01. The actual names are displayed when using the custom field editor.

Custom field properties

Each custom field, as listed under **Management > Custom Fields**, has properties.

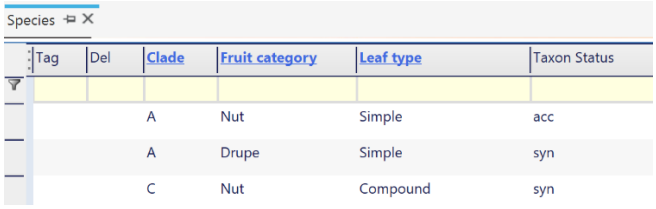


Custom field properties

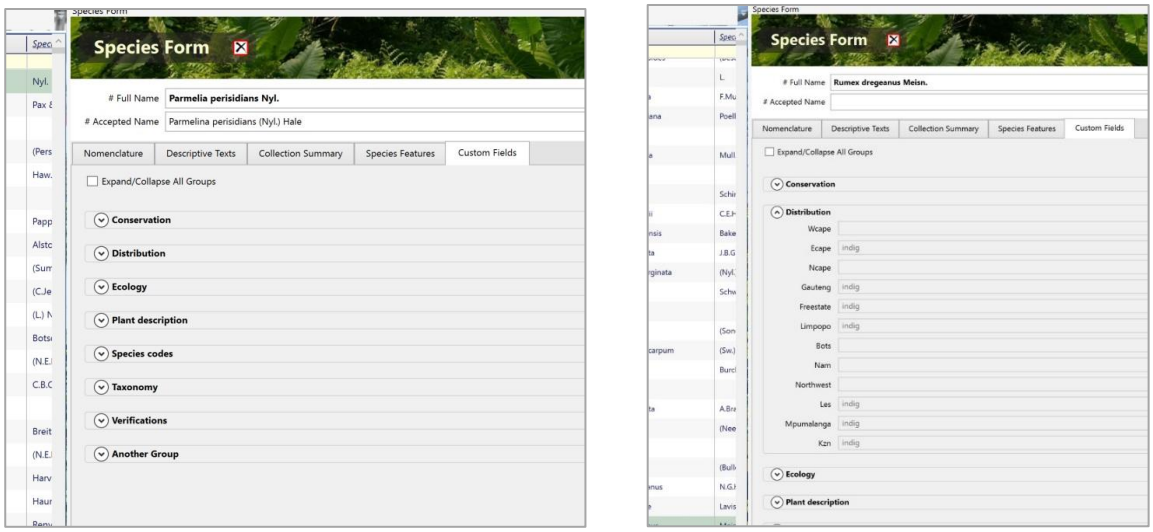
For example, for a datetime field, you can hide the time component.

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.



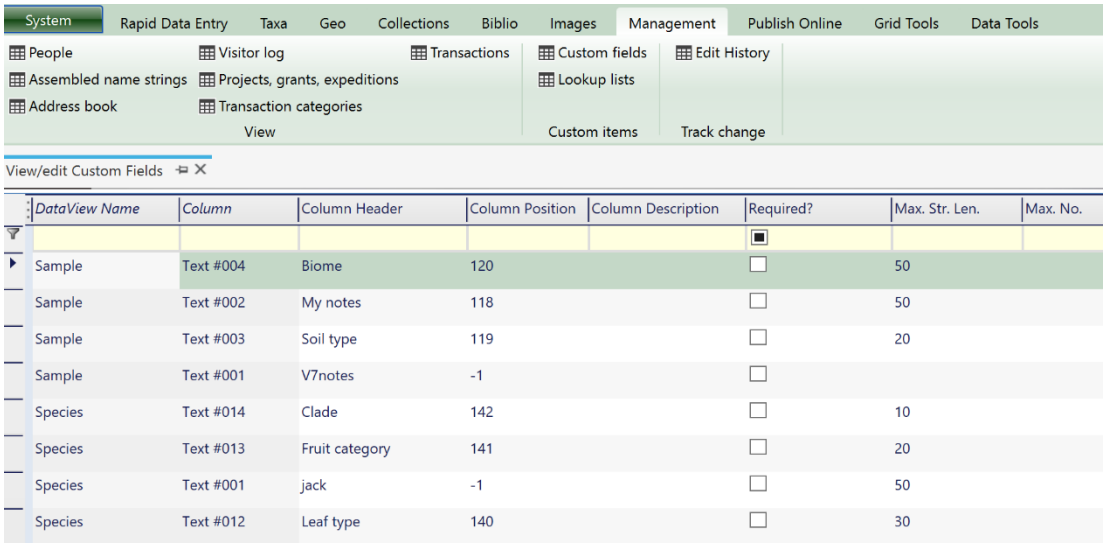
Custom fields appear in your main data grids, assuming they are selected for inclusion in your data grid view. They have a different font to standard fields.



Custom fields can also be edited on forms. When using forms, your custom fields are organised into field groups.

Viewing custom fields for all tables

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



DataView Name	Column	Column Header	Column Position	Column Description	Required?	Max. Str. Len.	Max. No.
Sample	Text #004	Biome	120		☐	50	
Sample	Text #002	My notes	118		☐	50	
Sample	Text #003	Soil type	119		☐	20	
Sample	Text #001	V7notes	-1		☐		
Species	Text #014	Clade	142		☐	10	
Species	Text #013	Fruit category	141		☐	20	
Species	Text #001	jack	-1		☐	50	
Species	Text #012	Leaf type	140		☐	30	

Snapshot of the central custom fields table.

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.

Exporting data from BRAHMS

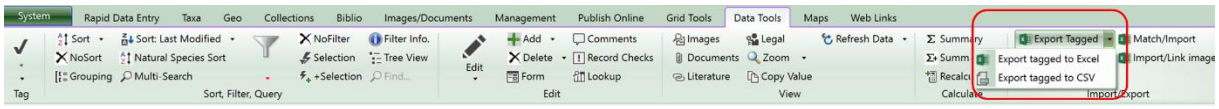
Introduction

Data can be exported from BRAHMS is a variety of ways as summarised here. Using one or more of these methods, you can export all data from BRAHMS into one or more formats.

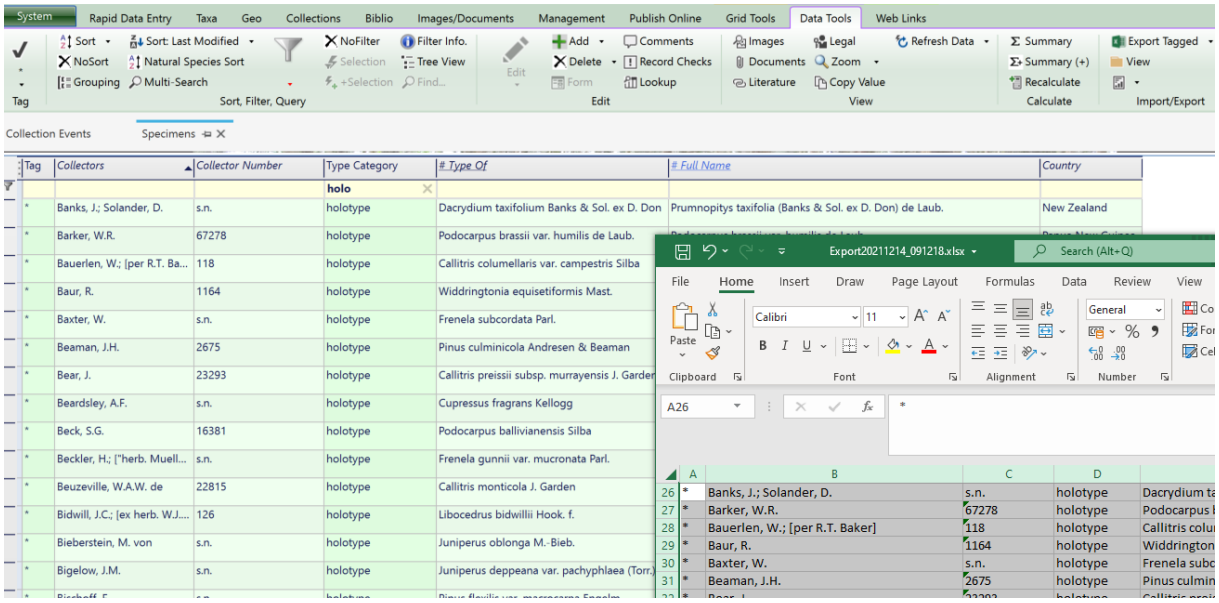
Export to Excel or CSV

You can export tagged records from any table to Excel or CSV using the options provided on the main Data Tools toolbar. Exporting works with tagged records and will export the currently selected columns in the current sort order. You can view all exported files using the **View** option.

From v8.7.5 onwards, for non-Admin users, exporting can be disabled by setting the appropriate user permission.



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



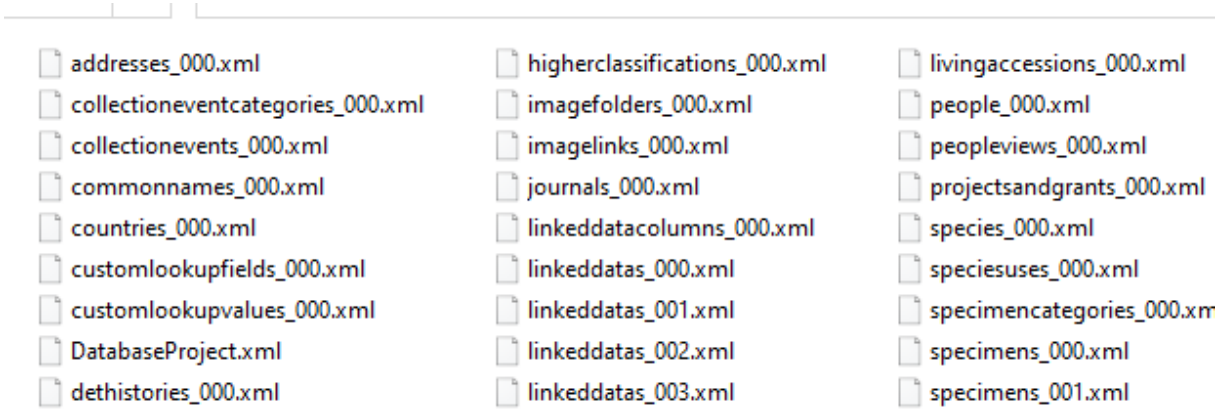
This example exports selected columns from a specimens table filtered on holotypes. Excel files can be opened directly after export.

Export an entire database to XML

The **Export** option on the Database Manager form is used to export all data from a selected database. This option does the reverse of the XML **Import tool**. It creates a folder of XML text files in a designated folder.

This option export all data from all tables in your database including all custom fields and setup options.

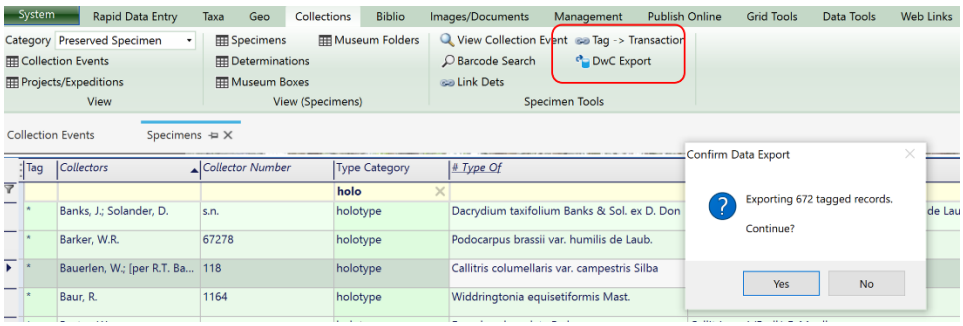
Using the export tool, you can export data from one database in any store type and then transfer the database to a new database in any other data store. For example, you could transfer your database from SQLite -> PostgreSQL or from PostgreSQL -> MS SQL Server.



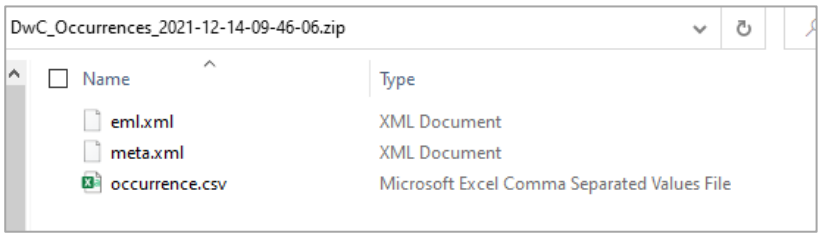
An example folder created by the Export to XML function. Large tables are split up in a numbered series, for example specimens_000.xml, specimens_001.xml, specimens_002.xml, … each file a fixed number of records.

Darwin Core Archive exports

You can create Darwin Core Archive (DwC) files currently from the main specimen and taxa tables. These files adhere to published DwC standards. With specimens, the occurrence.csv is provided with eml.xml and meta.xml files in a single DwC Archive zip. Further extensions are being added to the DwC option to cater for variations in export requirements. This will include the ability to add further standard and custom fields and provide the output heading required. These files can be submitted to Symbiota, GBIF and similar data networks.



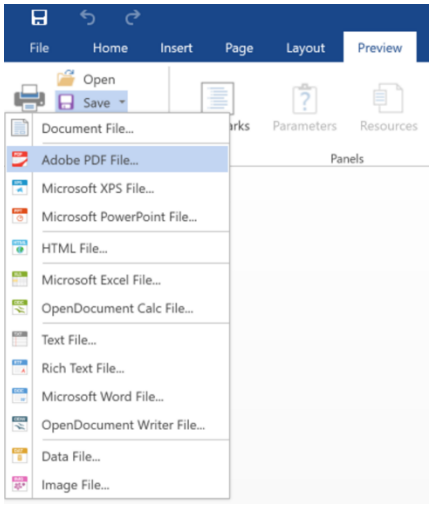
DwC output options are available for taxa and specimens.



Example DwC output as created from BRAHMS.

Exporting using reports

You can design reports to export data to different formats, for example to word, PDF, Excel and others including of course printers. Reports are used to export data from specific tables as managed by BRAHMS. However advanced users can also access and control the reporter directly, setting up data connections to any set of related tables.



Aside from printing, reports can be exported in the above listed formats.

Exporting to GIS

As discussed in the mapping sections of this guide, you can export data to your preferred GIS such as ArcMAP or QGIS. The data passed to the GIS are those data that you have selected in your data grid view.

Accessing your data store directly

IT staff can access any BRAHMS data store directly. Data are strongly documented with meaningful table and column names. You can access and query your data without restriction. You may wish to write software applications against the database.

Lookup fields and values

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 reduces typing errors and enforces 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 or Habit categories 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 in BRAHMS

Two main categories of lookup are used in BRAHMS:

a) All of the large tables have their own specialized lookup option, for example, for taxa, geographic and collector names. These lookups are discussed in the relevant manual sections such as that for finding taxa names.
b) Lookups that use data stored in your **central lookup fields table**. This single table holds lookup values for any data field that you have opted to register in your lookup dictionary. Examples are habit, language, colours, specimen categories, map accuracy codings, biome types, *etc.*

This section focuses on the use of the central lookup fields table.

The central lookup field list

Introduction

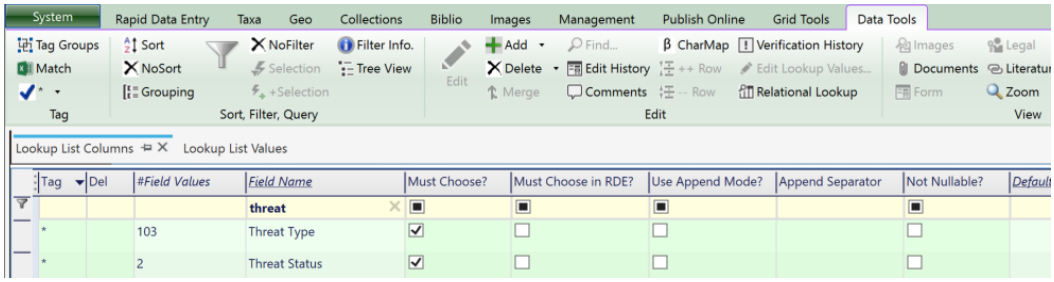
The central lookup list is used throughout the database and across all tables. Any field registered in the lookup list will be available in your system with the lookup values you add.

The lookup list consists of two related tables, one storing the list of registered fields with relevant settings for these fields. The other table holds the actual lookup values for each registered field.

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 the lookup values. The Lookup table does not store values for taxa, places, collectors and 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

Field name	
Tag	Standard BRAHMS tag field.
Del	Standard BRAHMS deletion field.
#Field values	Calculated field: number of lookup values for a field.
Field Name	The name of the field.
Must Choose	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.
Must Choose in RDE	As above but applies only to the field when in an RDE file.
Use Append mode	Multiple lookup values can be selected.
Append separator	Separator between multi-values, *e.g.* a comma or semi-colon.
Not Nullable	Null values are not permitted – thus the use must select a non-null value. If this is not selected, the user can set a field to null.
Default value	If Null values are not permitted, a default value should be added.
Field Comments	General notes about a field.
Audit fields	Added when and by whom, last modified when and by whom.

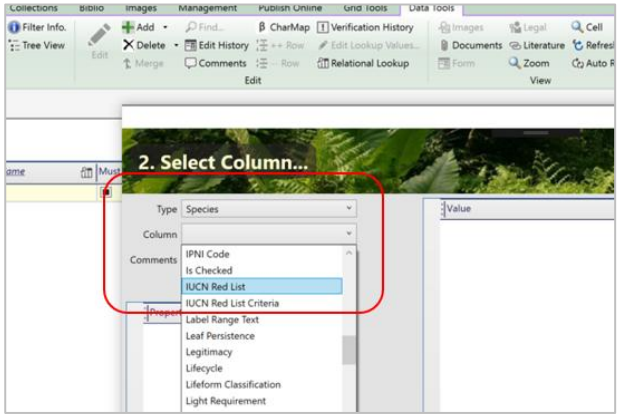
The above listed field settings allow you to refine and control how users will use the lookup fields. Note that these settings can be controlled to allow different rules for the same field in the main tables and in RDE.

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.

Registering a lookup field

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



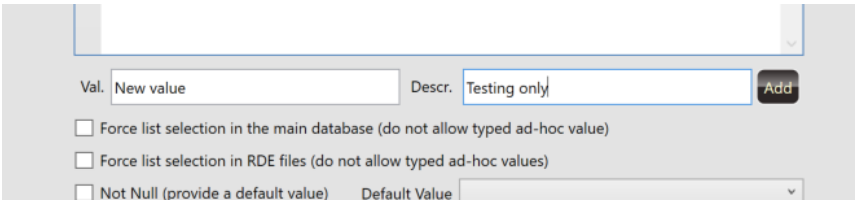
Selecting a column to add to your lookup list.

- Select the **Type** 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, A) do not add lookup lists for fields that have their own specialised lookups. For example, do not add a lookup for the fields 'Species' or 'Species Author' in the species table. B) avoid adding lookups for fields that have a very large number of values as these tend to slow up activities in that table.

When you select a new field value, the existing data values for the new 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 (**Add ->**) or all (**Add All**) of the current values to your lookup list.



In the above example, the LLORIGIN field is not yet registered in the lookup list. This 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 develop the lookup list for this field. You can also add new values by typing them in. Bear in mind that the existing values may include entries that you do not want to include in your clean lookup list. Rogue values (e.g. spelling variations) ideally ought to be edited in the data table at some stage.



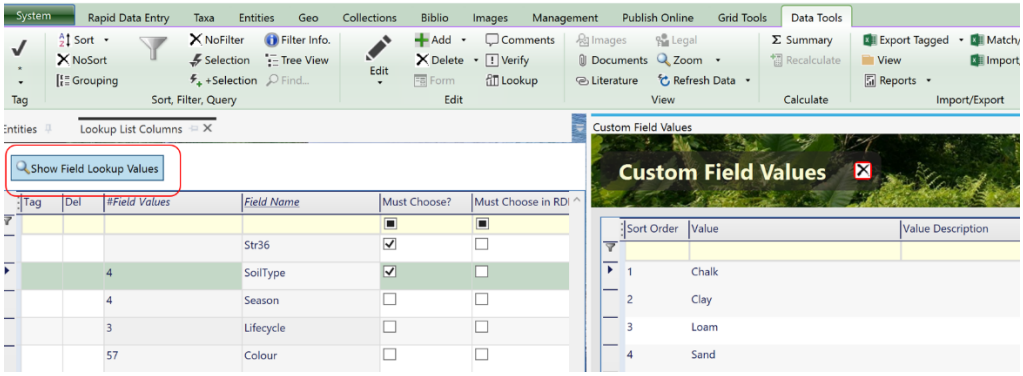
Manually adding a new value to the lookup list.

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.

Default lookup value and sort order

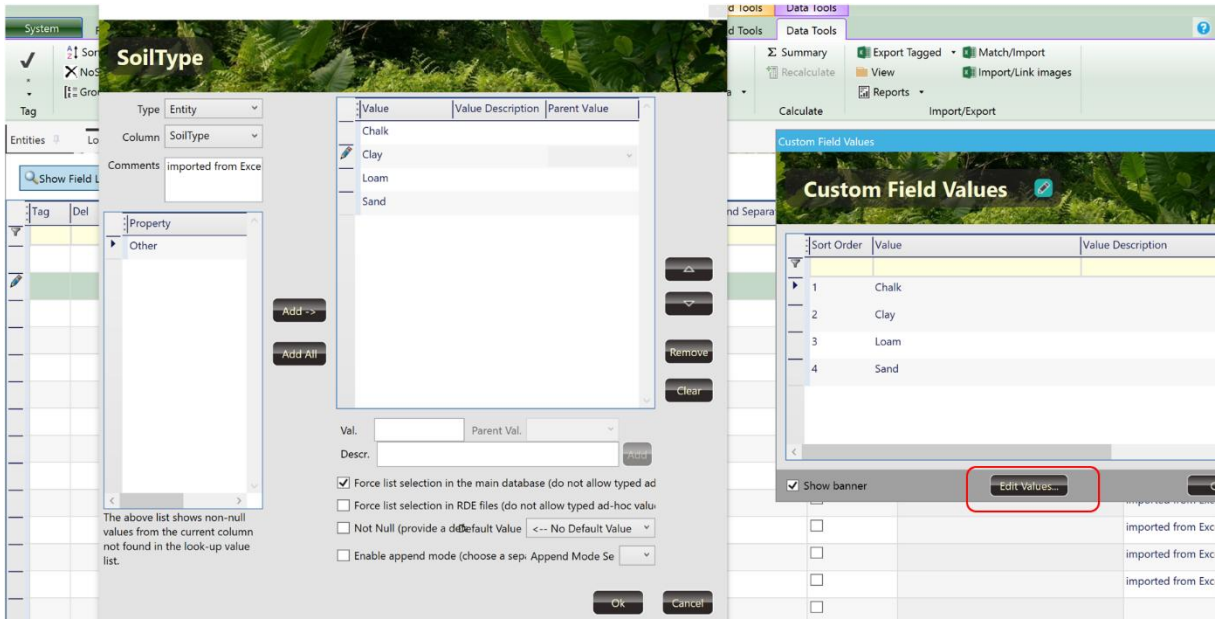
When defining a lookup field and it's values, you can select a default value and you can also choose the sort order for your values.

Editing lookup field values



Use the Show Field Lookup Values option to list values currently registered for a field.

To edit values, ensure you are in **Edit mode** and then select the **Edit Values** option.

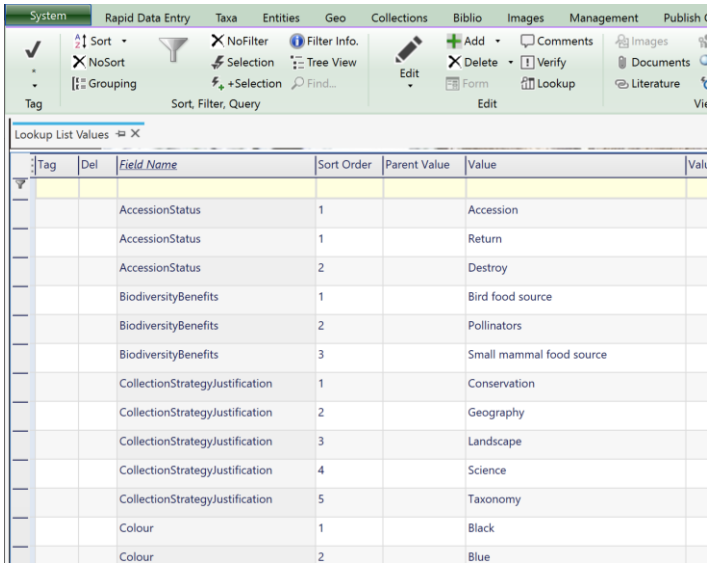


When editing values, you can add new or remove values and alter their sort order.

Listing all lookup values

To list all lookup field values across all fields, select the **Lookup Values** option on the Lookup Fields drop-down.





Tag	Del	Field Name	Sort Order	Parent Value	Value	Valu
		AccessionStatus	1		Accession	
		AccessionStatus	1		Return	
		AccessionStatus	2		Destroy	
		BiodiversityBenefits	1		Bird food source	
		BiodiversityBenefits	2		Pollinators	
		BiodiversityBenefits	3		Small mammal food source	
		CollectionStrategyJustification	1		Conservation	
		CollectionStrategyJustification	2		Geography	
		CollectionStrategyJustification	3		Landscape	
		CollectionStrategyJustification	4		Science	
		CollectionStrategyJustification	5		Taxonomy	
		Colour	1		Black	
		Colour	2		Blue	

You can save these data to Excel or print using a custom report.

Adding lookups for custom fields

Lookups can be added for custom fields in the same way as for any other field. Where possible, custom fields, as well as being available in data grids, are added to a special tab on forms.

Field value table

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

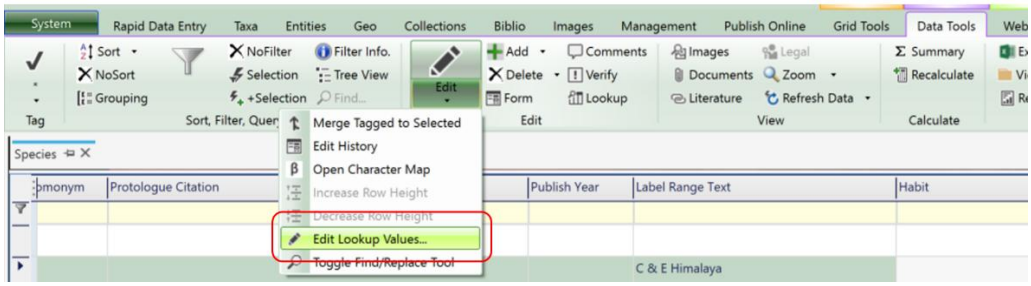
Deleting a lookup field

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.

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** option dropdown **Edit Lookup Values** on the **Data Tools** toolbar. A non-Admin user needs permission to do this.

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Use Edit Lookup Values on the Edit dropdown to create or edit lookup lists when you are editing a data grid.

This opens the same edit options described above.

Importing lookup values from Excel

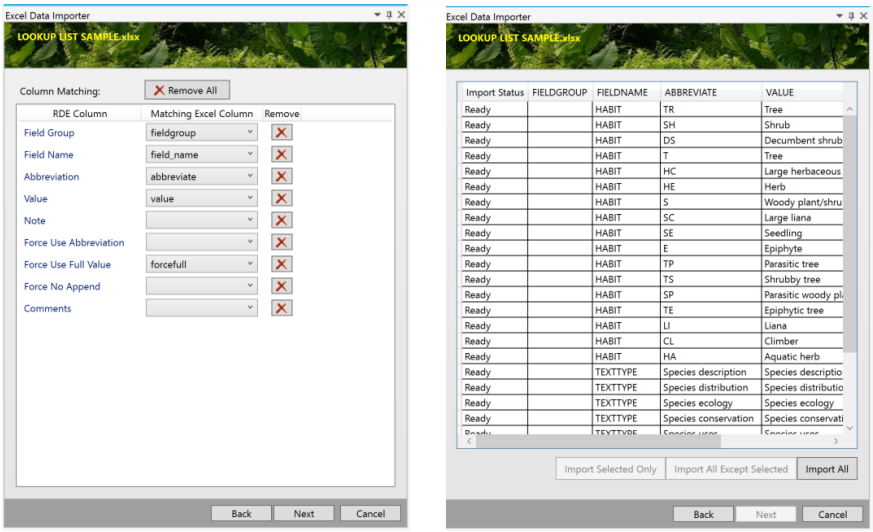
Look up values can be imported from Excel tables. Some tables are provided by the BRAHMS project for a range of data categories. But you can also develop your own lookup lists. For example, you may have lists of values for biomes, soil types, insect wing colours or flowering stages. Rather than adding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

For Excel imports, use **Management > Import from Excel**. The format for the xlsx file is as follows:

	A	B	C	D
1	FieldName	SortOrder	LookupValue	ValueDescription
47	HormoneConcentration	1	2000ppm	
48	HormonePrepType	1	Other	
49	HormonePrepType	1	Kiba	
50	GraftType	1	Chip Bud	
51	GraftType	1	Side Veneer	
52	GraftType	1	Cleft	
53	GraftType	1	1 bud	
54	GraftType	1	Whip and Tongue	
55	CutType	1	Semi-hardwood	
56	CutType	1	Softwood	
57	CutType	1	Hardwood	
58	AcidConcentration	1	Mild	
59	AcidConcentration	1	Concentrated	
60	AcidType	1	Nitric	
61	AcidType	1	Hydrochloric	
62	AcidType	1	Sulphuric	
63	PropagationContainer	1	Germination flat	

Your xlsx table must include the columns FieldName and LookupValue. The fields SortOrder and ValueDescription are optional.

The field names themselves must be the same as the physical table fields and these are often different to the 'friendly' names used in the data grids and field lists options. A good way to get the correct name is to manually add a lookup value and check the Field Name value added to the lookup grid.

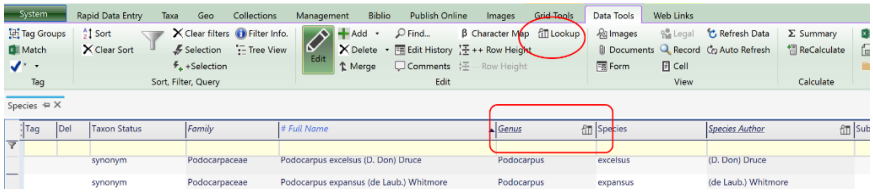


When importing, ensure that minimally, you have the Field Name, Abbreviation and Value fields matched as shown above. The right screen shows the data in the Excel table ready to import.

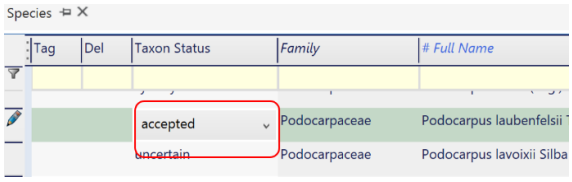
Using lookups

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.

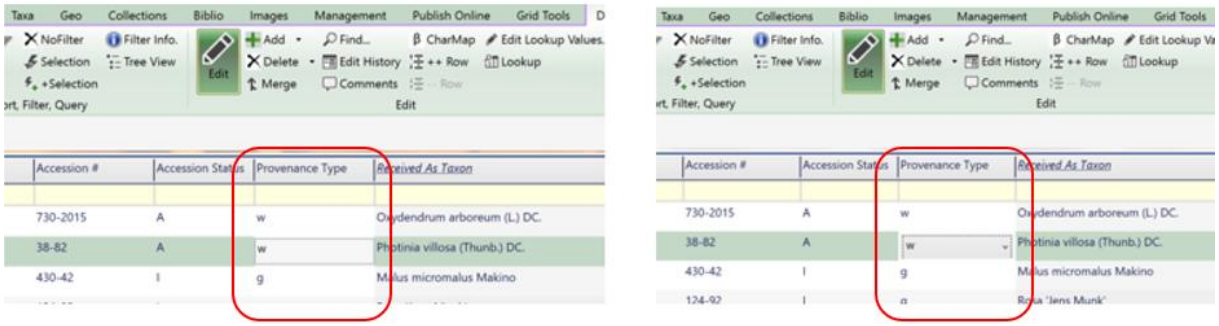


Fields that have values in your lookup table (see below) have a drop down or lookup button added to the field.

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.

Single value selections and dropdowns

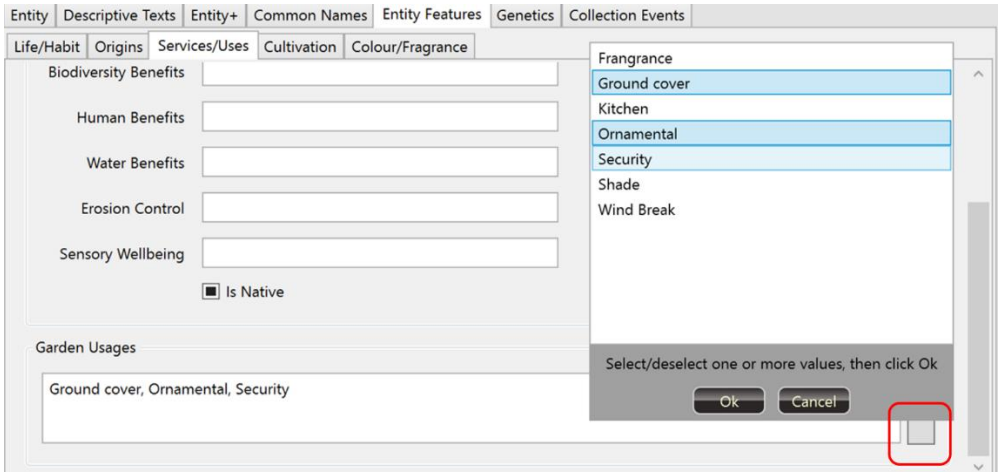
As soon as you add any entries for given field to your lookup list – and you are in **edit mode**, the data field in the data grid and on the form displays as a dropdown rather than a free entry text box. Depending on the settings in your field list table, users will be forced to choose one or more values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



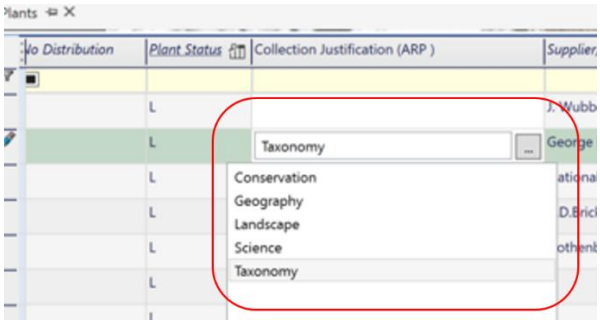
In the left side example, no entries have been registered in the lookup list for Provenance Type. Hence the field can be freely edited. The right-side example shows the field after one or more entries have been registered and the user is forced to select one of the dropdown options.

Multi-value selections

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.



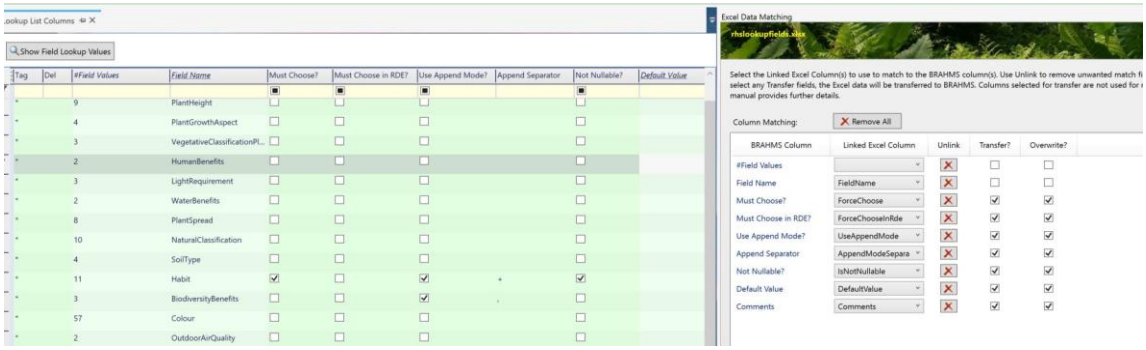
In Append mode, the lookup button assembles the existing values to a list box where they can be selected.



Multi-value lookups can also be used in the data grids.

Transferring lookups from one database to another

1. Open the database with the good lookup settings.
2. Select **Management > Lookup Fields > Lookup Values** (drop-down option). Tag all records and export tagged to a suitably named Excel file using the **Export Tagged** option.
3. Select **Management > Lookup Fields.** Tag all records and export all records to Excel.
4. Log in to the new db. Select **Management > Lookup Fields > Management menu again > Import from Excel**.
5. Step through the import wizard - all the field setting in the Wizard should be correctly matched. Complete the import.
6. Again, select **Management > Lookup Fields.**
7. This time, select the **Match/Import tool** on the Data Tools menu.
8. Locate the Lookup Field file exported above in step 3. The match settings should be as in the screen below, matching on fieldname, transfer and overwrite all others.



Using the Match/Import tool

Rapid Data Entry

While data can be entered directly into BRAHMS, the use of Rapid Data Entry (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 is an essential tool for those entering a lot of new data records.

Comprehensive documentation for RDE has now been moved to a separate PDF Using Rapid Data Entry (RDE).

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:

Map option	Installation required	Must be online	Base maps required
BRAHMS ArcGIS API	No	Yes	No
ArcGIS / ArcMap	Yes	No	Yes
QGIS	Yes free	No	Yes
Diva GIS	Yes free	No	Yes
GeoCAT	No	Yes	No
Google Earth	Yes	Yes	No

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

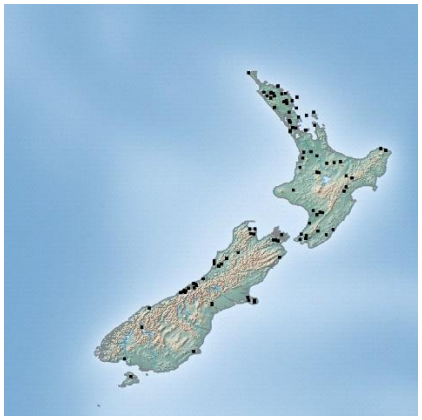
Field	Notes
Latitude	Latitude of the point
Longitude	Longitude of the point
LLResolution	Coded resolution of map data ranging from 1 to 8 (optional)
LLOrigin	Coded origin of map data (optional)
LLDatum	Geodetic Datum value e.g. WGS84, NAD83
QDS *	Quarter Degree Square value e.g. 2830CB
# DGMS	Calculated field for labels *e.g.* 16° 19' 59.998" N, 96° 35' 59.999" W
Tag	Standard BRAHMS field – but can be used to control which records are plotted

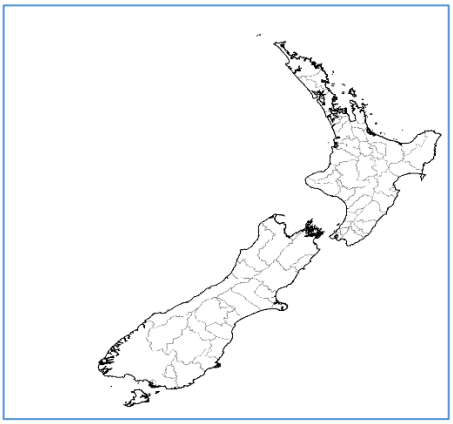
Cultivated	Standard BRAMS field – can be used to control which records are plotted

* http://www.ngi.gov.za/index.php/what-we-do/maps-and-geospatial-information/41-sa-mapsheet-referencing

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 has numerous layers with global coverage. Excellent raster and vector maps are also available on http://www.naturalearthdata.com/features/.





Global raster and vector map data are freely available on http://www.naturalearthdata.com/features/ and 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/ and choose Cultural (large scale data for the most detailed map) and download the Admin – 0 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

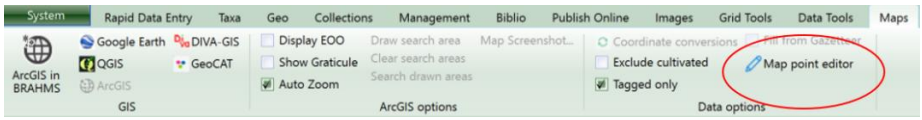
The map location editor can be used in RDE and in the main tables for collection events and botanic garden plant points. This can be tested in the RDE file opened above. You can use the map location editor to add a new map point or edit an existing one. You need to be online to use this feature in BRAHMS.

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.

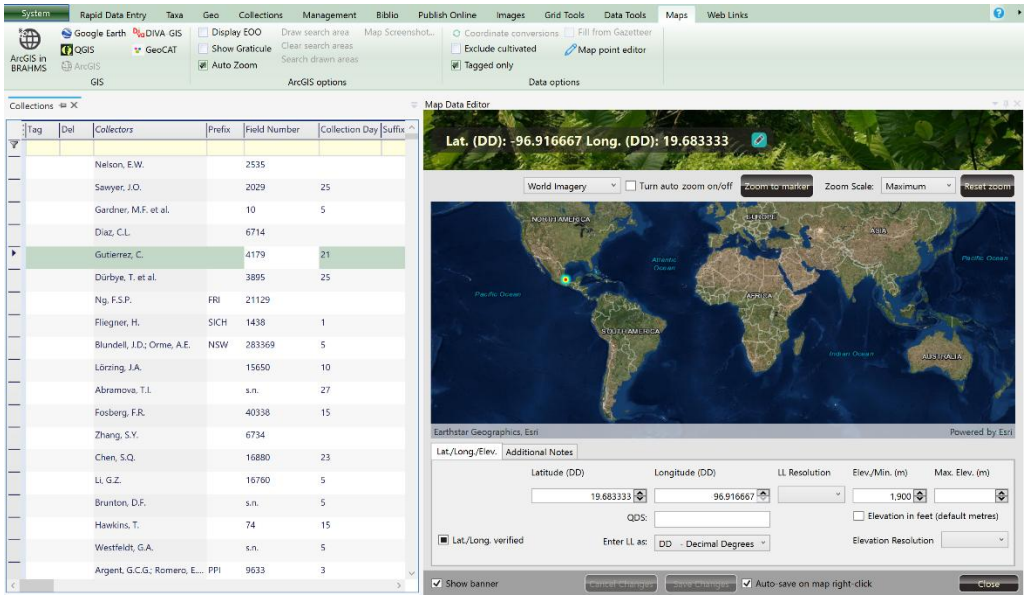
Although data in BRAHMS are always stored in decimal degree format, you can manually enter data in degrees minutes and seconds or in decimal minute formats. However, the ability to select or edit the point on the map reduces the need to type in data.

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

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

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.

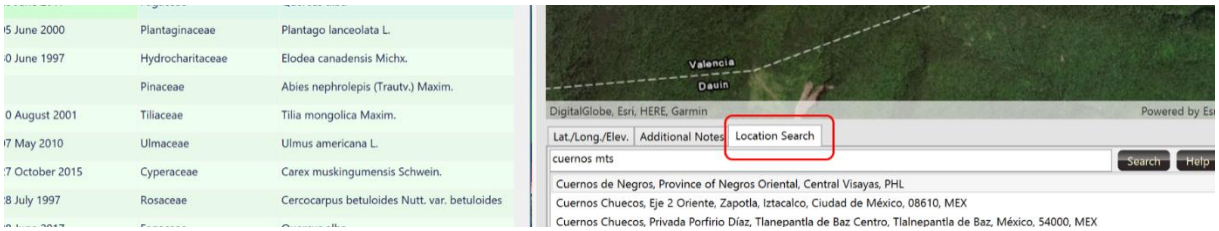
Sorting by collection date or by latitude + longitude

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 and longitude, as you scroll down the grid, the points will follow the geographic sort.

Location searching

The internal Map Point Editor, dynamically connected to your data grids, has a location search tool. Localities can be searched for by name or part of a name, adding a region or country to help improve the results listed. Clicking on the suggested locations list adds a blue suggestion marker to the map. A right-click on the map adds the map reference to the data grid. The location search is very similar to that provided in e.g. Google Earth.



Calculating distances with the Map Point Editor

It is often necessary to adjust a map point position based on a distance measurement, for example where collection locality notes say '20km west along route 249'. This is done using the internal Map Point Editor Distance Measurements option. Distances can be calculated in different units and the corrected point can be auto-added to your data grid.



After drawing a polyline, a right-click on the map will update the data grid map reference.

Mapping using the ArcGIS API

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

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

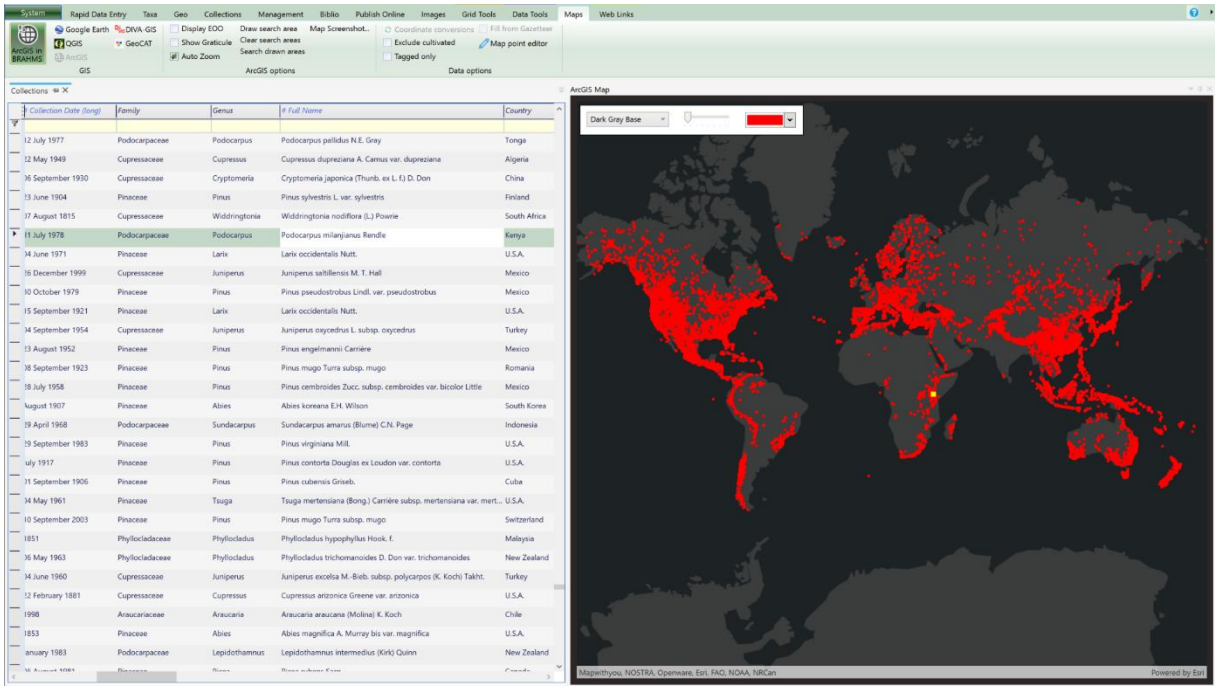
Introduction

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:

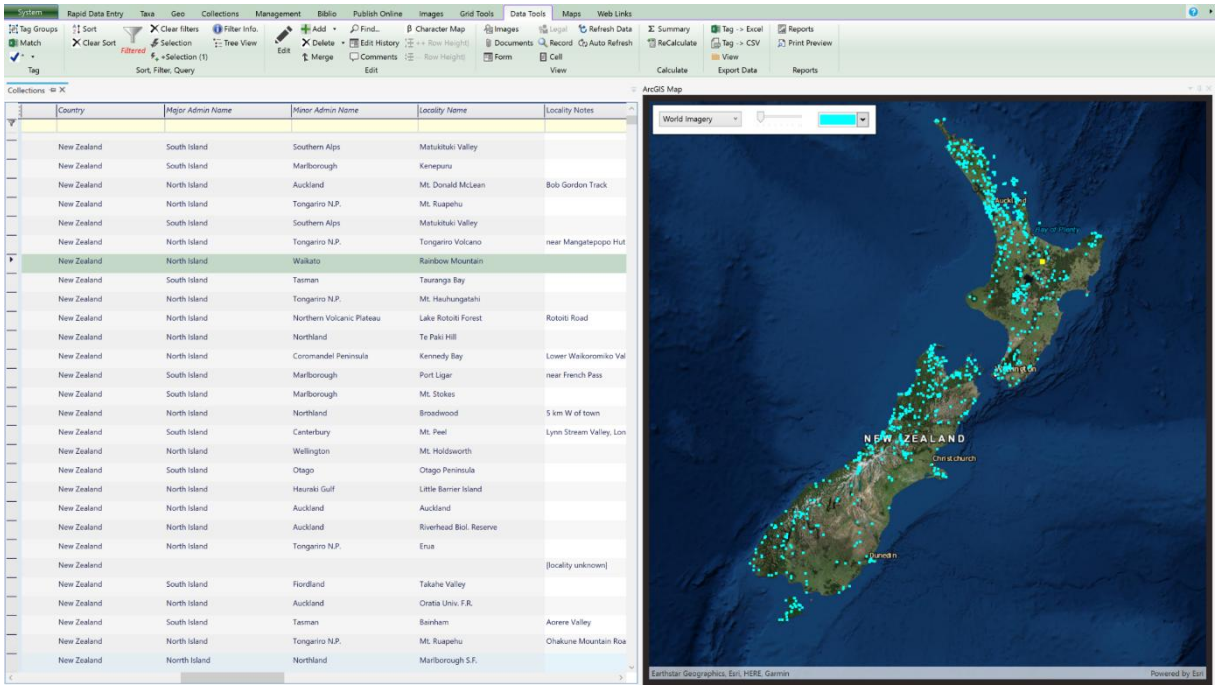
- No installation required;
- data points are highlighted on the map as you browse through your data grid;
- clicking on a map point tags records 'M' in your data grid, an excellent way to locate errors;
- maps are auto-updated as you apply grid filters;
- calculation of Extent of Occurrence (EOO);
- 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

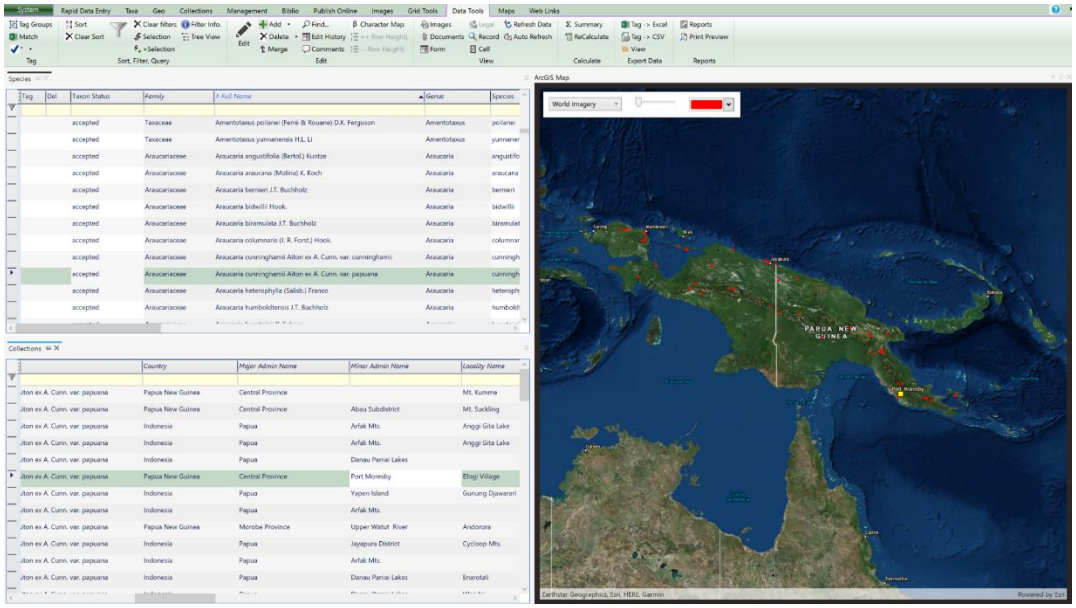
- Select **Collections > Collection events** then select the **Mapping** toolbar followed by **ArcGIS in BRAHMS**. If no filter is applied, by default, this will plot all **tagged** records. To plot records, tagged or not, adjust the **Tagged only** option. The map window can be dragged to another monitor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



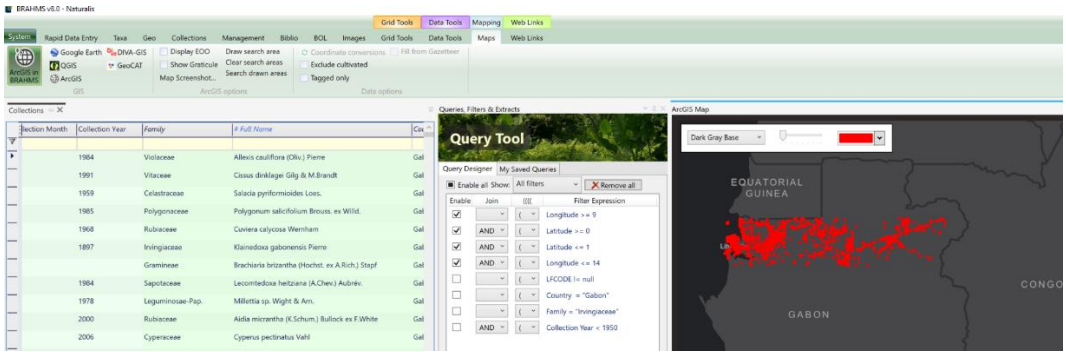
A map displaying all conifer collections (no filters applied). The setting here does not restrict to tagged records and a dark gray base map is selected. The current record (Kenya) is hightlighted on the map.



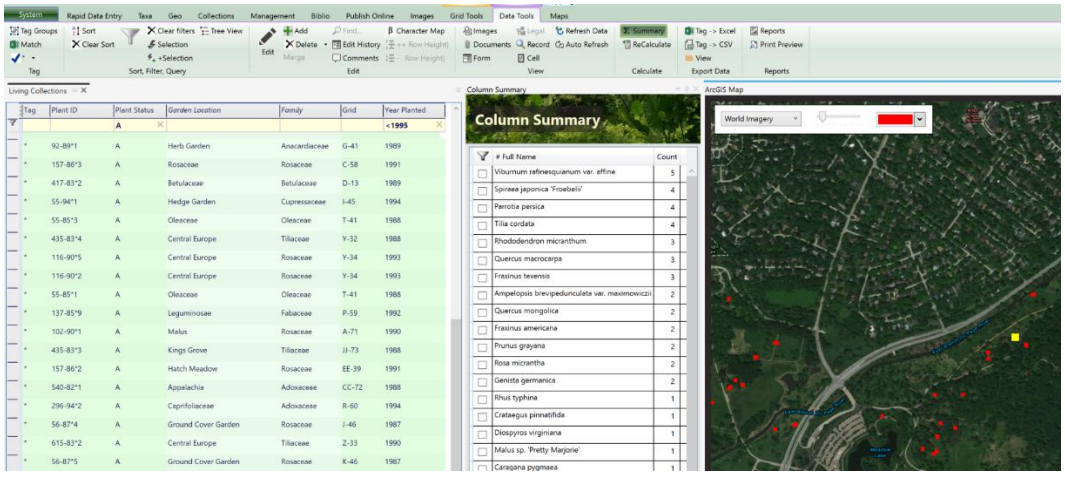
Here, a filter set on New Zealand with the base map set to World imagery, the point colour has been changed and the current grid record is highlighted.



*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.*



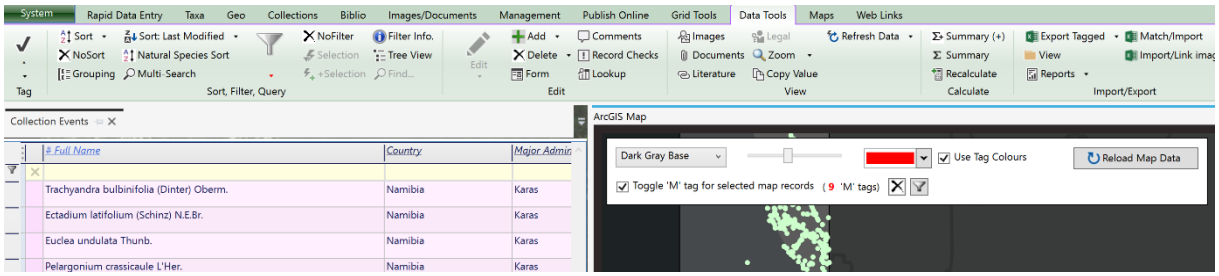
An example using the main query tool to define a rectangular grid area. This is a useful way to save a commonly used search similar to 'grid box' searches in version 7.



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 point tagging

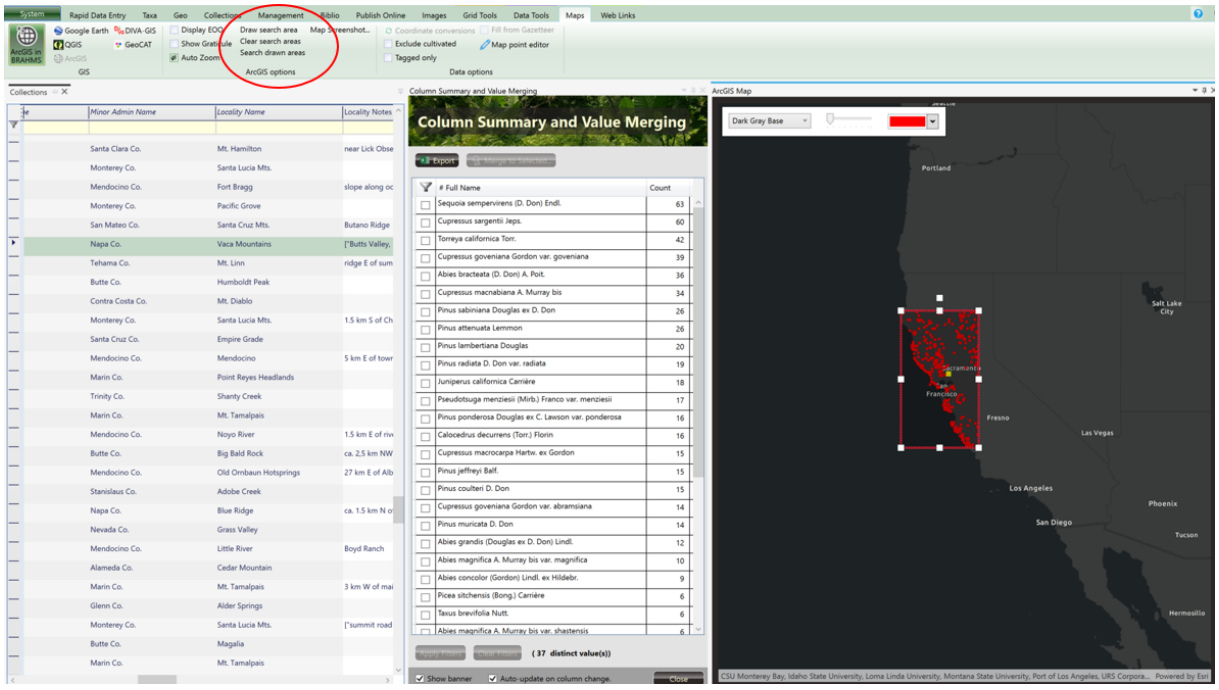
Using the Toggle tag option, you can click on map points to tag 'M'. These may be error points that you want to check. Your can then use the map Filter toolbar to filter your grid to the M tagged records.



Clicking on map points with tag mode enabled, you can selectively mark-up map point then filter your data grid.

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.*

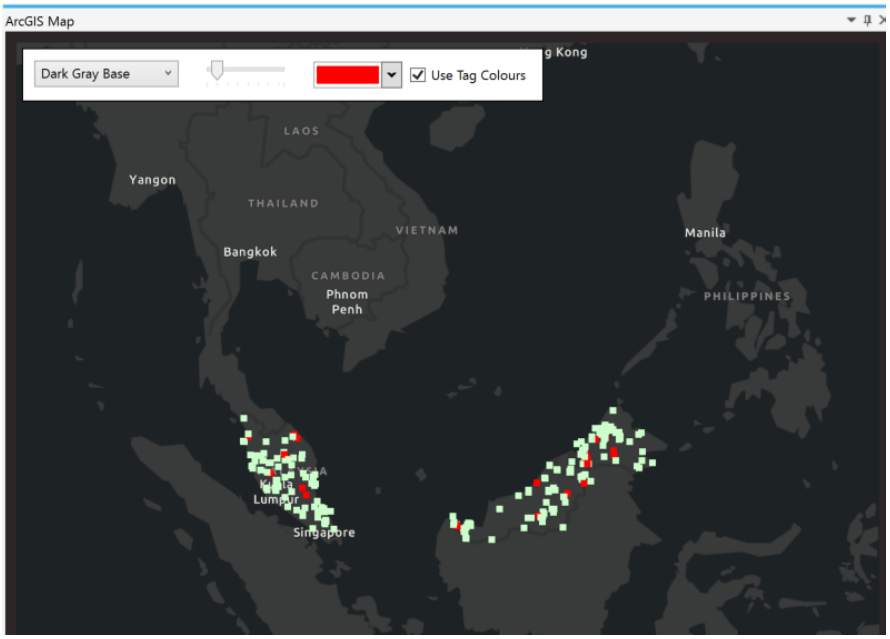
Map Auto-Zoom

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.*

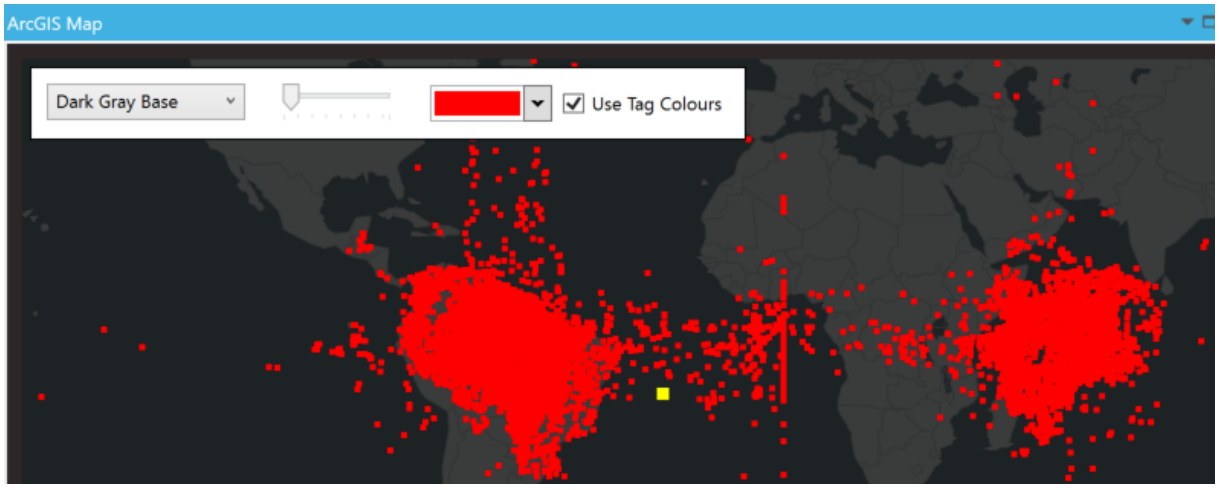
Map point colours



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

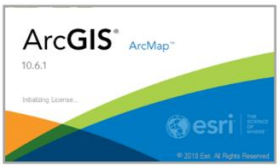
Most museum or garden databases with geo-referenced data include errors. Map data errors have many potential causes and correcting these if often a priority for projects.



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

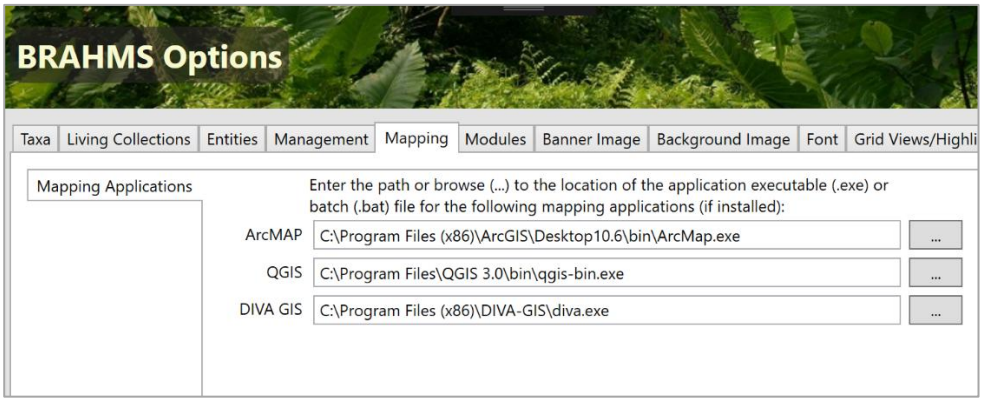
Setup for ArcMap, QGIS, DIVA





While BRAHMS does it 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

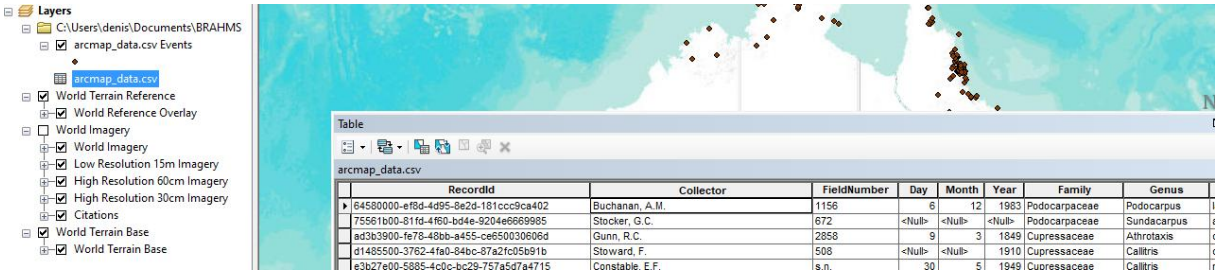
Introduction

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

Data fields passed to ArcMAP

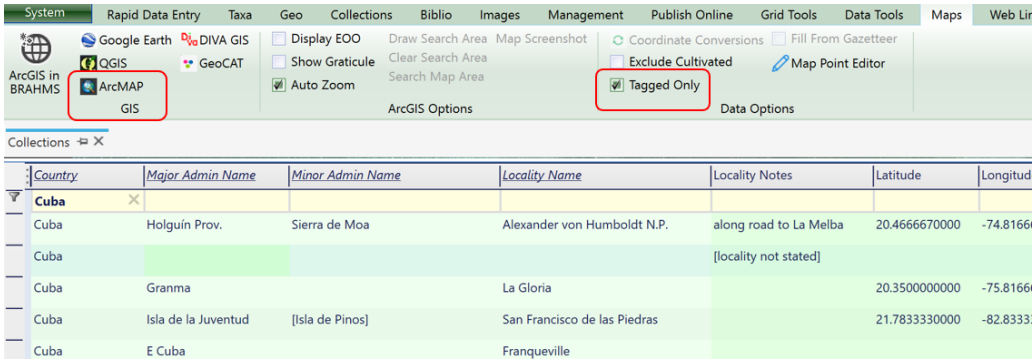
When you plot data to ArcMAP, all of the fields in your currently selected field view are passed in csv format. You can include standard and custom fields. The fields Latitude and Longitude must be included.

RecordID and data editing

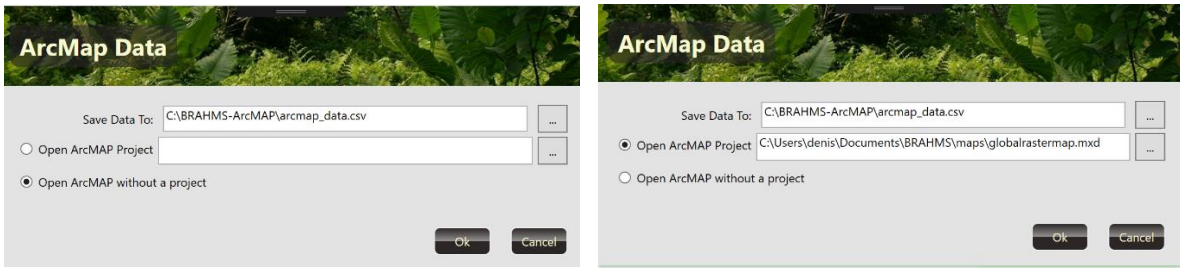
The **Record ID** is the GUID identifier of the record in BRAHMS. This means that selected data can be edited using GIS tools and then transferred back to BRAHMS, updating the table accordingly. For example, you may have used some tools you have added to or developed in ArcMAP to check and adjust map 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

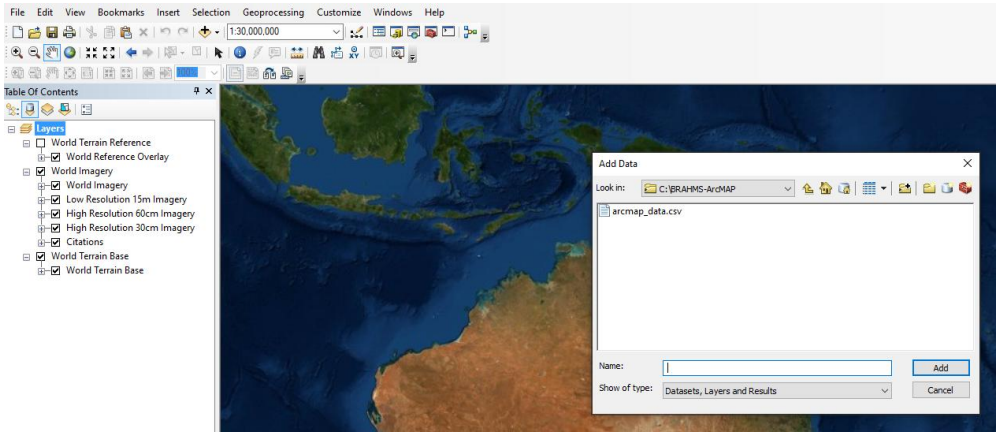
To open ArcMAP, use the **ArcMAP** option on the M**aps** toolbar. Note that this option will not be enabled if you have selected Tagged Only and no records are tagged. Mapping output will respect filters. Thus, you can set a filter (in the example below a country name) and/or restrict to tagged records.



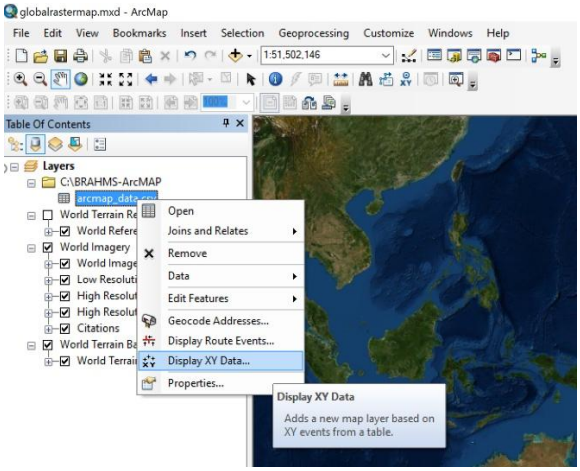
The ArcMAP option will not be enabled if you have selected Tagged only but have no tagged records.



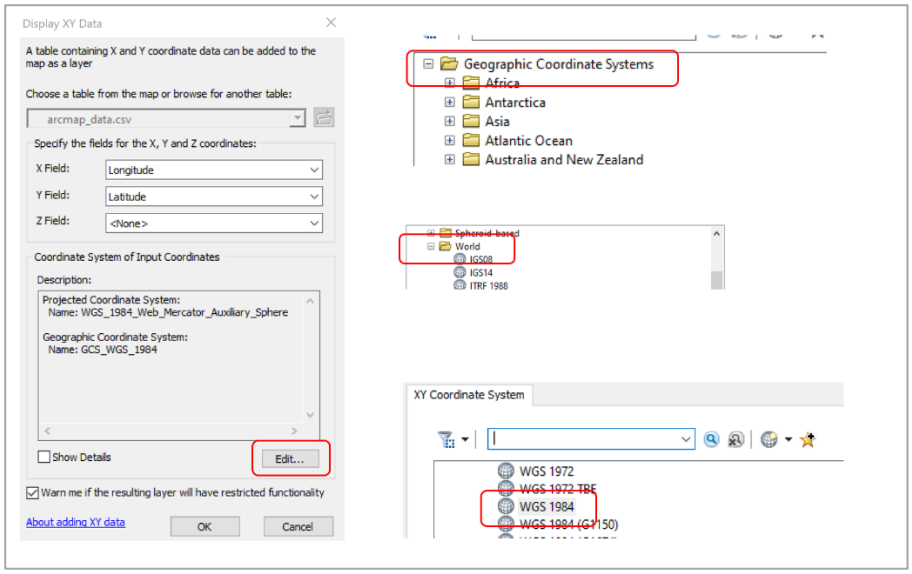
Opening ArcMAP with no project selection. Right. Selecting an existing project (default).



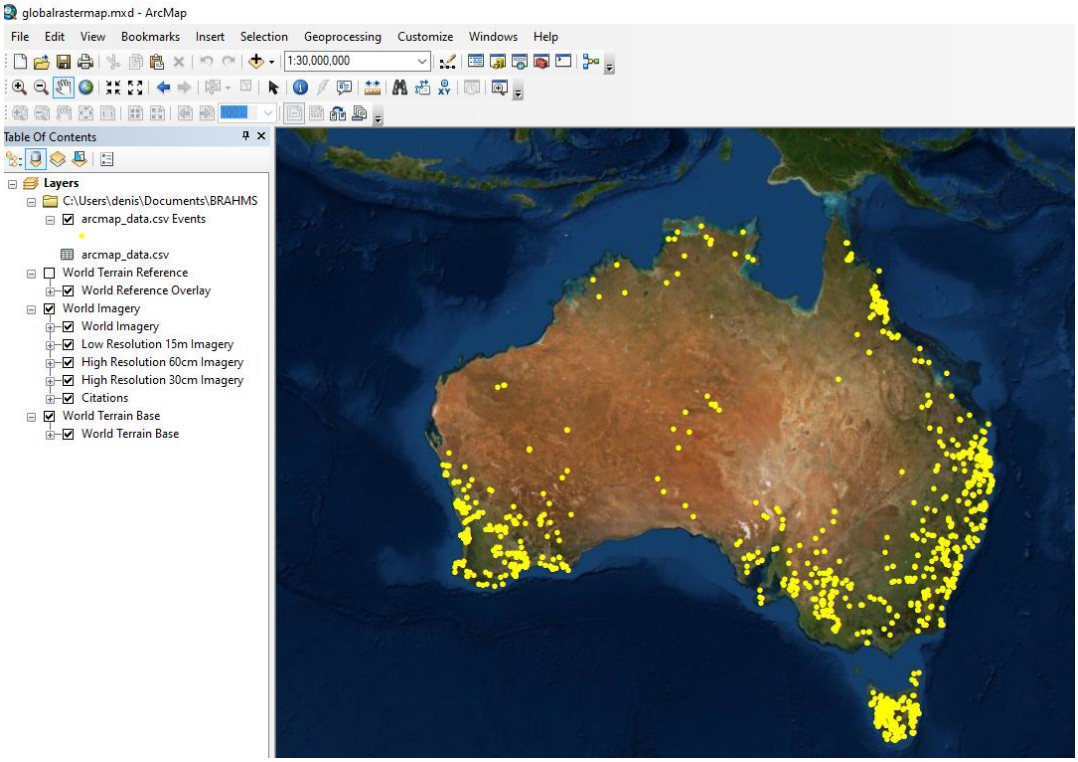
Here, an existing project has been opened and using the ***Add Data*** *option on the ArcMAP toolbar, the BRAHMS output file arcmap_data.csv is located. Note that you may need to register this data folder so that ArcMAP can locate your csv data file.*



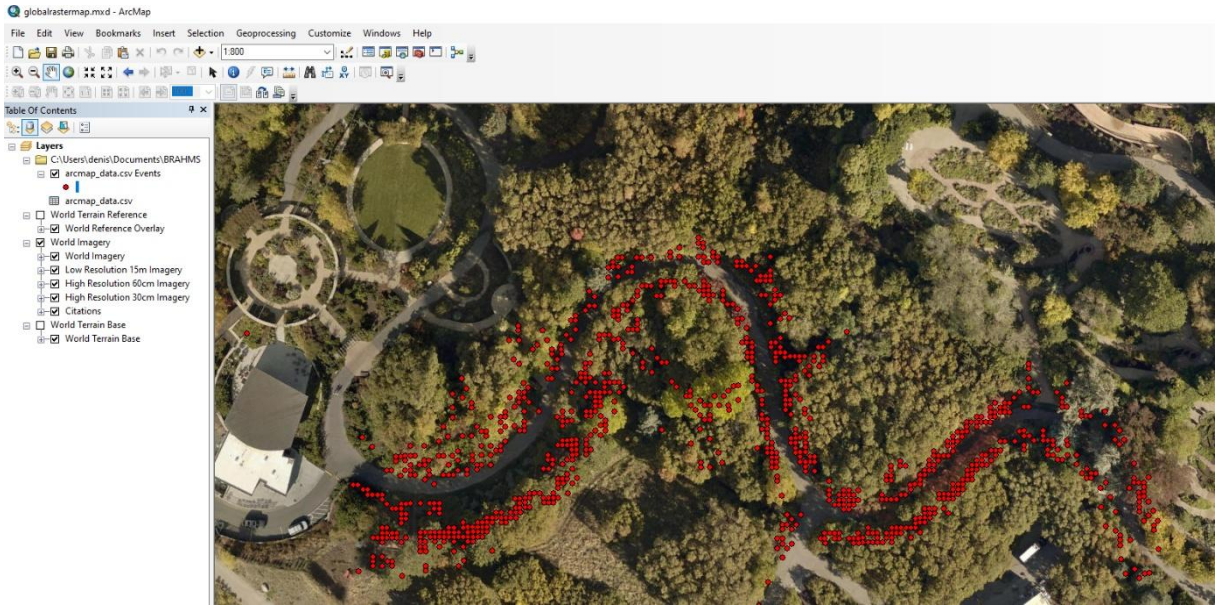
At this stage, you could open this table by right-clicking on the csv and select ***Open****. The next step is to correctly register this csv data file as a map layer. To do this, right-click on the csv and select* ***Display XY Data****.*



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

Video samples are provided on https://herbaria.plants.ox.ac.uk/bol/brahms/software/v8videos

QGIS is a mapping package – freely available on 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

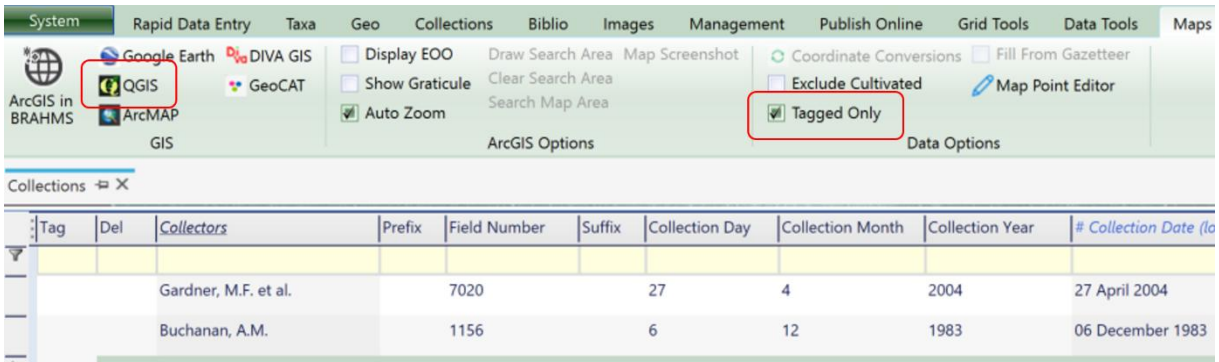
When you plot data to QGIS, all of the fields in your currently selected field view are passed in csv format. You can include standard and custom fields. The fields Latitude and Longitude must be included.

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

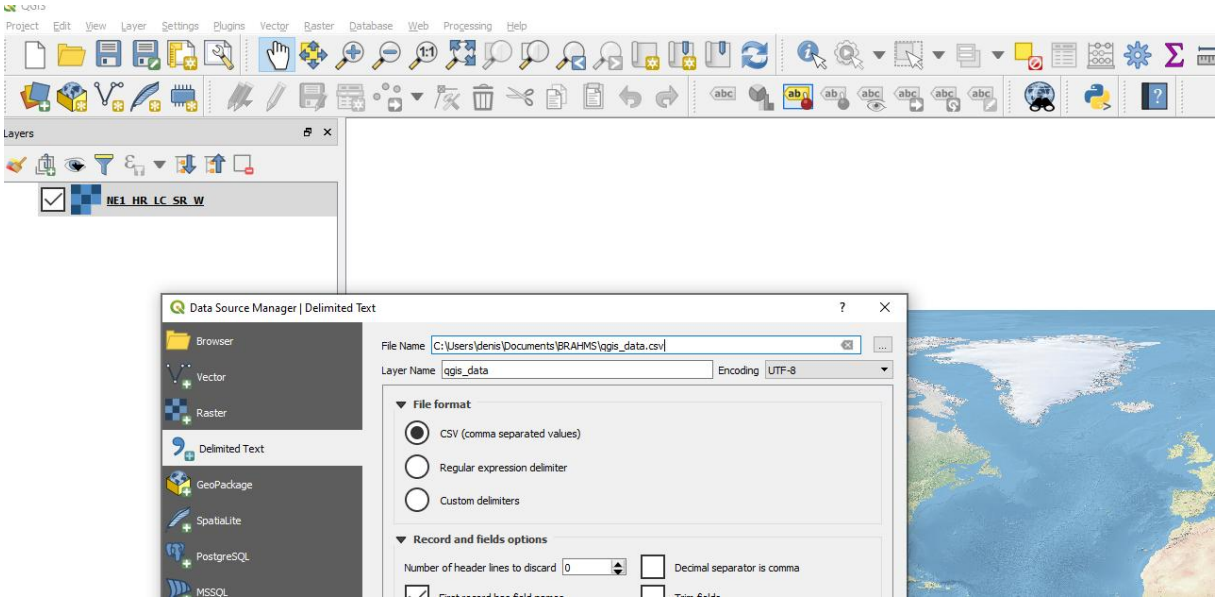
To open QGIS, use the **QGIS** option on the M**aps** toolbar. Note that this option will not be enabled if you have selected Tagged Only and no records are tagged. Mapping output will respect filters. Thus, you can set a filter (in the example below a country name) and/or restrict to tagged records.



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

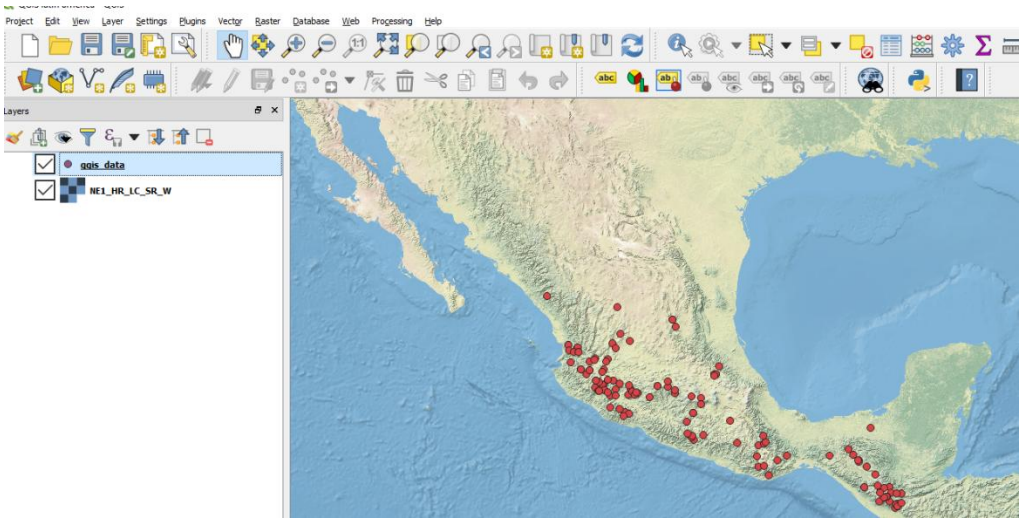


Opening QGIS with no project selection. Right. Selecting an existing project (default).



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.

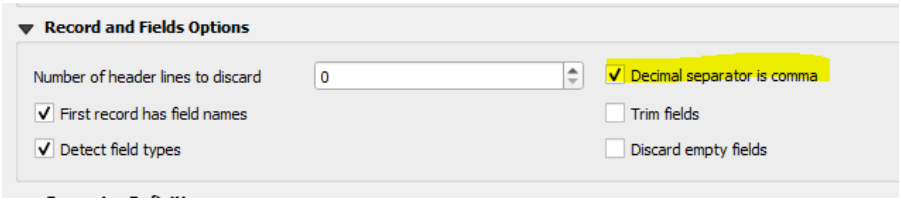


Once added, you can save the project with the registered data layer.

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.

Decimal point separators

The default for latitude/longitude values uses points as decimal separators. If you use commas, make sure you select the QGIS option as below:



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.

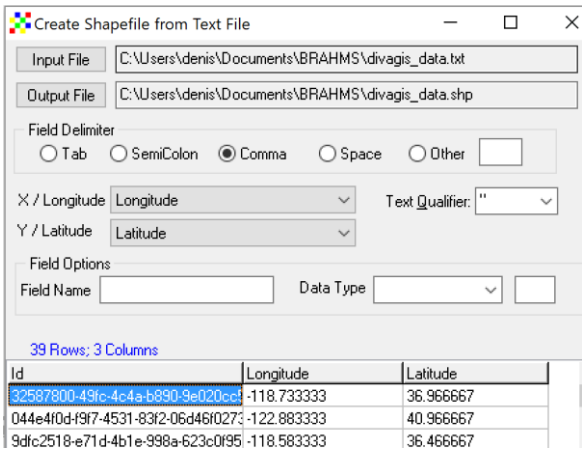
Once Diva is opened (you may have chosen a saved project with existing map layers):

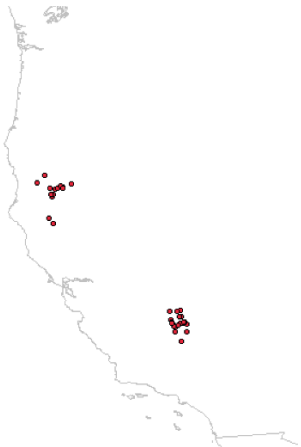
Add the map layer(s)

- 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*.

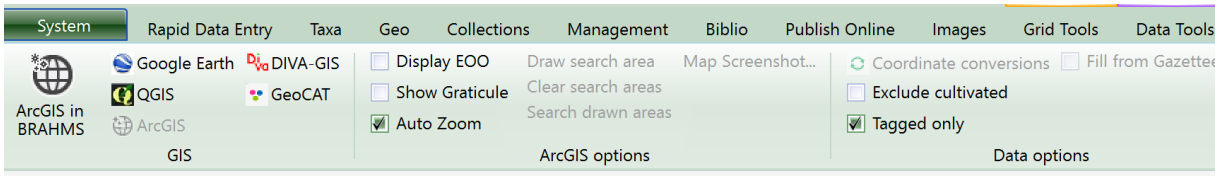




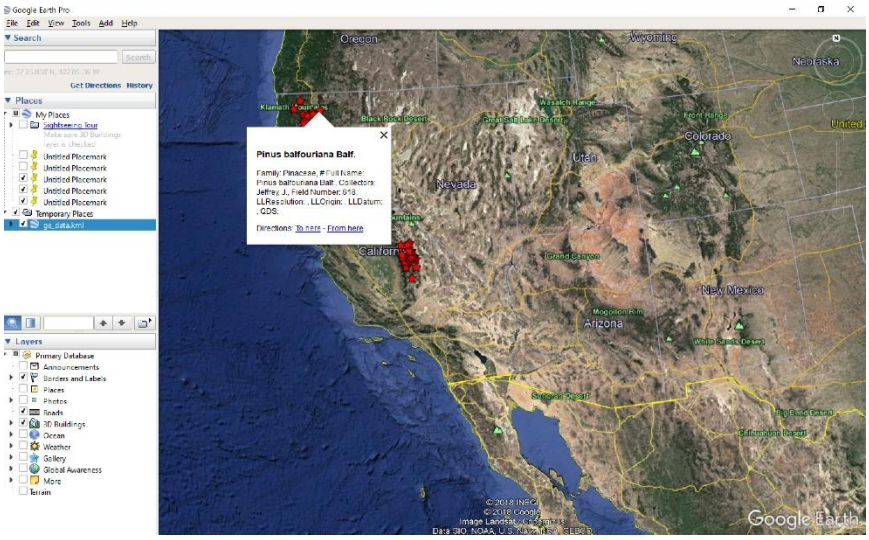
Once you are at this stage, select Apply on the Diva form and your points will appear.

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.

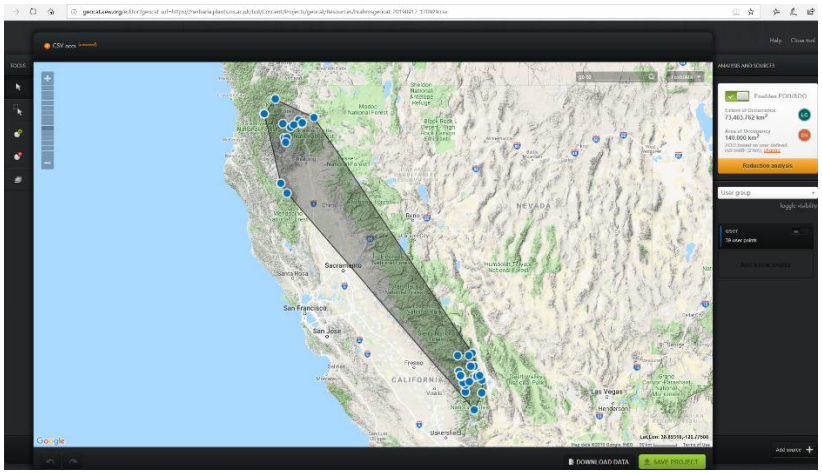


Mapping to Google Earth



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.

Reports and report templates

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. Comprehensive documentation on designing and running reports has been moved to a separate PDF Reports And Report Templates.

The Getting Started Training Guide also includes some reporting tasks. And there is a detailed PDF on Designing Specimen Labels. This latter document includes a comprehensive explanation on how report field expressions can be used.

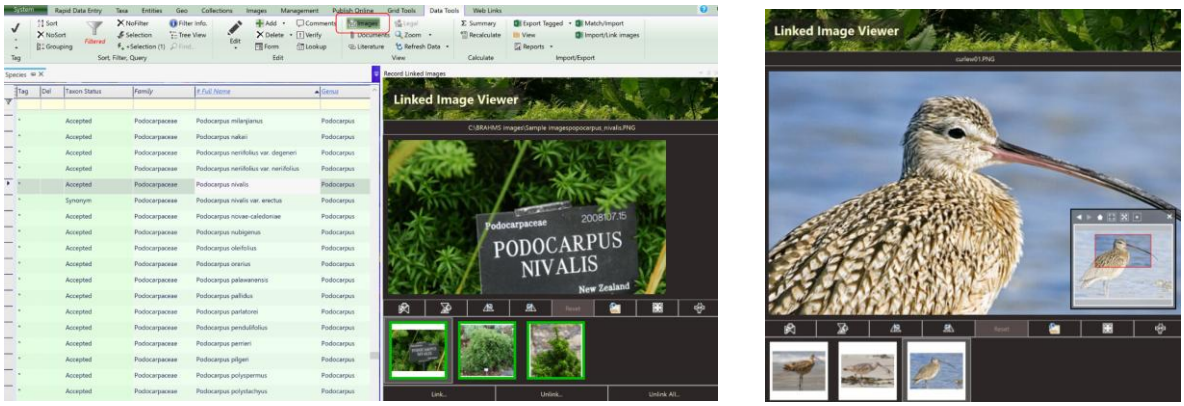
Image Management



Image Management PDF

Images of any standard file type and/ or image URL links can be linked to records in any table in BRAHMS and may also be uploaded to BRAHMS online websites.

See Image Management PDF document.

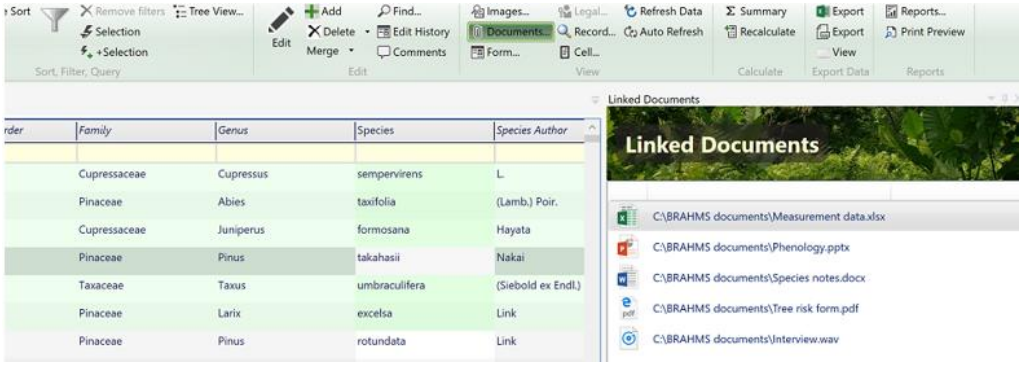


Viewing images in BRAHMS. The image viewer and further tools and features are documented in full in the separate document as indicated above.

Document management

Introduction

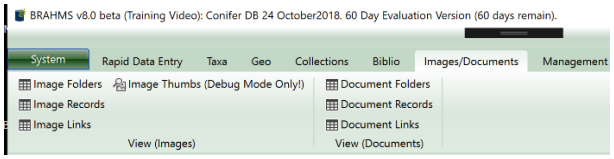
Multiple documents of any type can be linked to any record in BRAHMS. This could be a PDF material transfer agreement or collection permit linked to a specimen, accession or transaction; a protologue description linked to a species; a sound file linked to an animal entry; or perhaps a video or slideshow linked to a botanic garden greenhouse record. You can also link URLs as documents. These may be references to documents that require user permissions to view, for example, as stored in SharePoint.



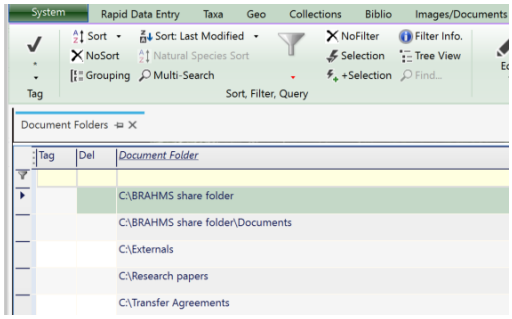
Linking pdf, docx, wav, pptx and xlsx documents to a species record. Media and documents can be opened using the Open option or double-clicking on the linked entry.

Documents, document folders and database links

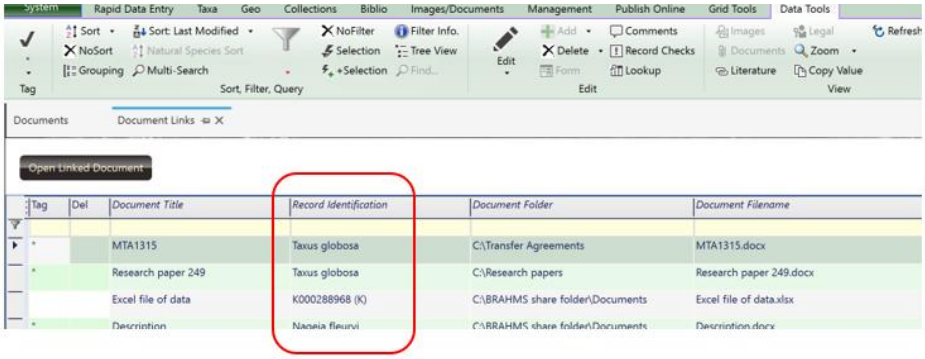
Documents are managed under the **Images/Documents** menu option. All linked documents, including URLs, are registered in the main documents table. Folders are auto-registered in a separate folders table. You can also view and filter on all document links for your database.



The main Images/Documents menu.



Document folders in use are listed in the folders table



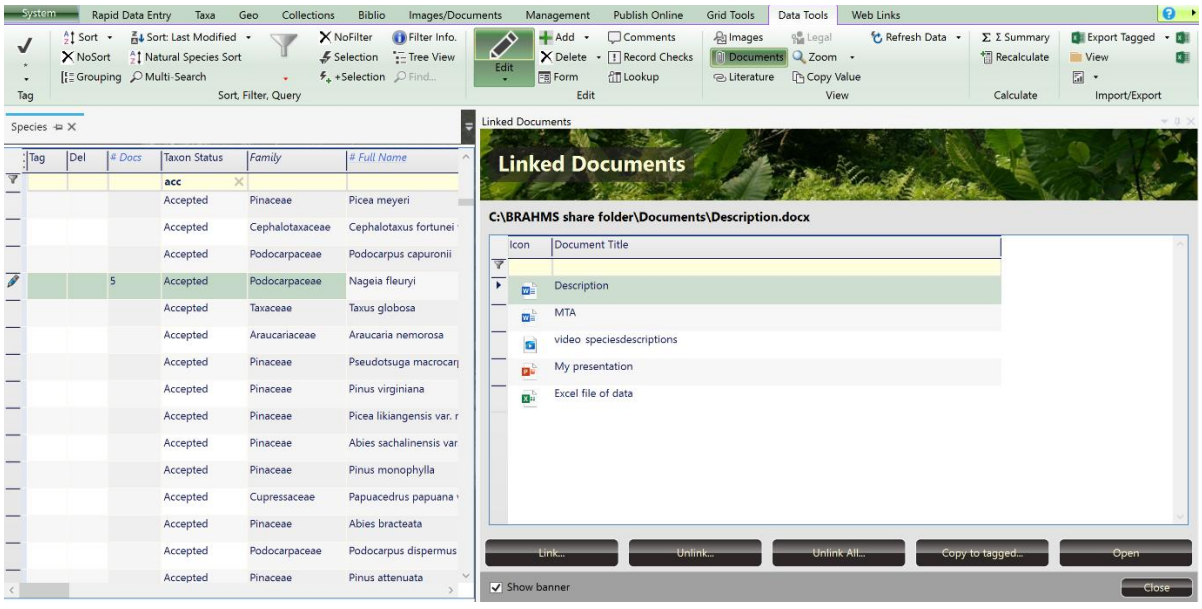
In the document links table, the Record Identification field indices which record the document is linked to.



The option Document Links shows all links between documents and records in your database.

Editing document links

In any record, you use the **Documents** toolbar option to open the Linked Documented editor. In Edit mode, drag documents on to the window or use the Link option. Double-click a link to open the document. You can copy a linked document to all tagged records.



Viewing and editing document links.

Dynamic weblinks

Weblink toolbar

You can dynamically link your data records in any table to external websites as provided on the **WebLinks** toolbar. From BRAHMS v8.6 onwards, WebLink options are configurable, allowing you to add websites that you find most useful. As an ornithologist, mycologist, plant taxonomist or a researcher with another interest, you can select personal Web Link connections as well as use sites that are shared across your BRAHMS project.



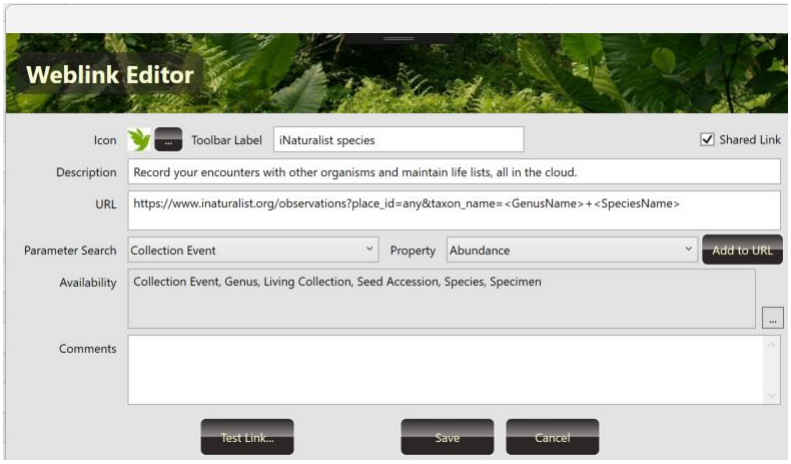
An example of the weblinks toolbar, edited to show a selection of website links.

Add your own weblinks

Web Links can be configured to include search parameters that enable dynamic searching as you move through your data grid records. The Web Links editor on the **Management** menu includes options to select icons and toolbar text; add the URL with the appropriate search parameters utilizing any BRAHMS data field from the relevant table; set whether the link is personal or shared; choose the BRAHMS tables your weblinks are associated with; and set the order in which they appear. The ability to edit Web Links is permission controlled.

In the following example, a dynamic link to iNaturalist is added:

- Select **Management > Manage Weblinks** and then **New Link**.
- Enter the data as provided in the below screen.



You can download the logo by searching for 'iNaturalist' logo. Then upload this to the Weblink Editor using the icon lookup. Keep the toolbar label as short as possible. The description is optional. The entry in the URL text field is:
https://www.inaturalist.org/observations?place_id=any&taxon_name=<GenusName>+<SpeciesName>
but you could also use e.g.
https://www.inaturalist.org/observations/<Int06> where <Int06> is a BRAHMS custom field name holding the iNaturalist ID code.

The field names inside <> are interpreted when you use the weblink, replacing the BRAHMS field names with the actual data values.

You can use the **Parameter Search** and Property options to help locate the correct search field names in the respective table.

Setting the **Availability** using the multi-value lookup button is important as this dictates which tables the weblink option will be available for. Thus, if you want this toolbar to appear in the species table, make sure “Species” is added to the availability list.

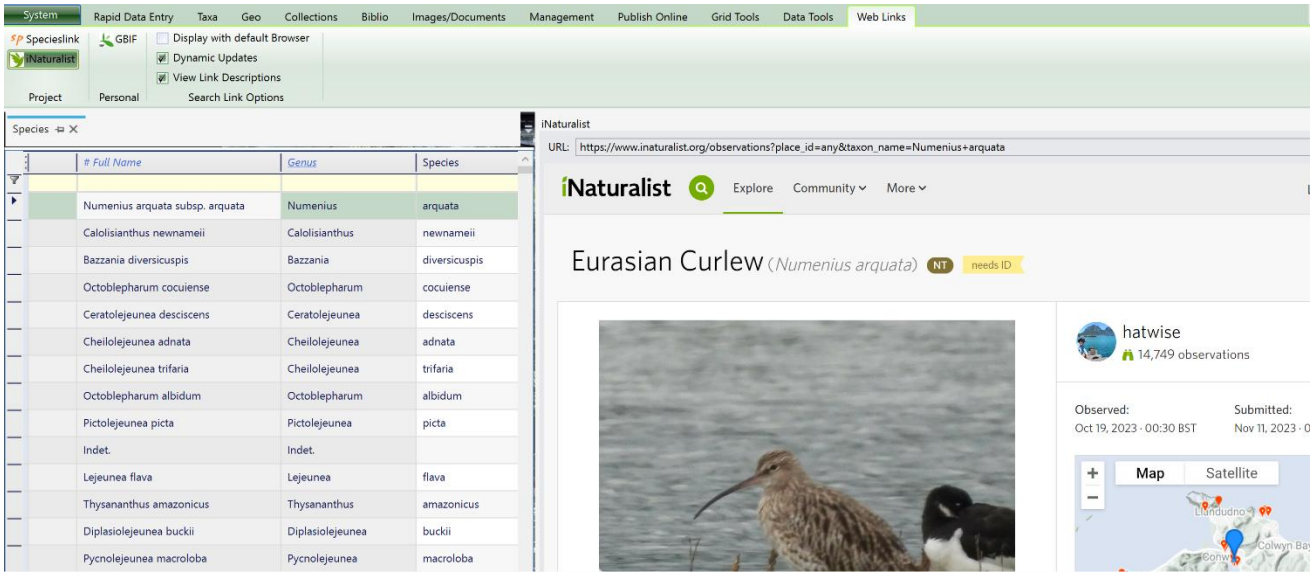
Weblinks can be personal (user-specific) or shared. The **Shared Link** option dictates whether other users on a network system will see your weblinks.

Import/Export weblinks

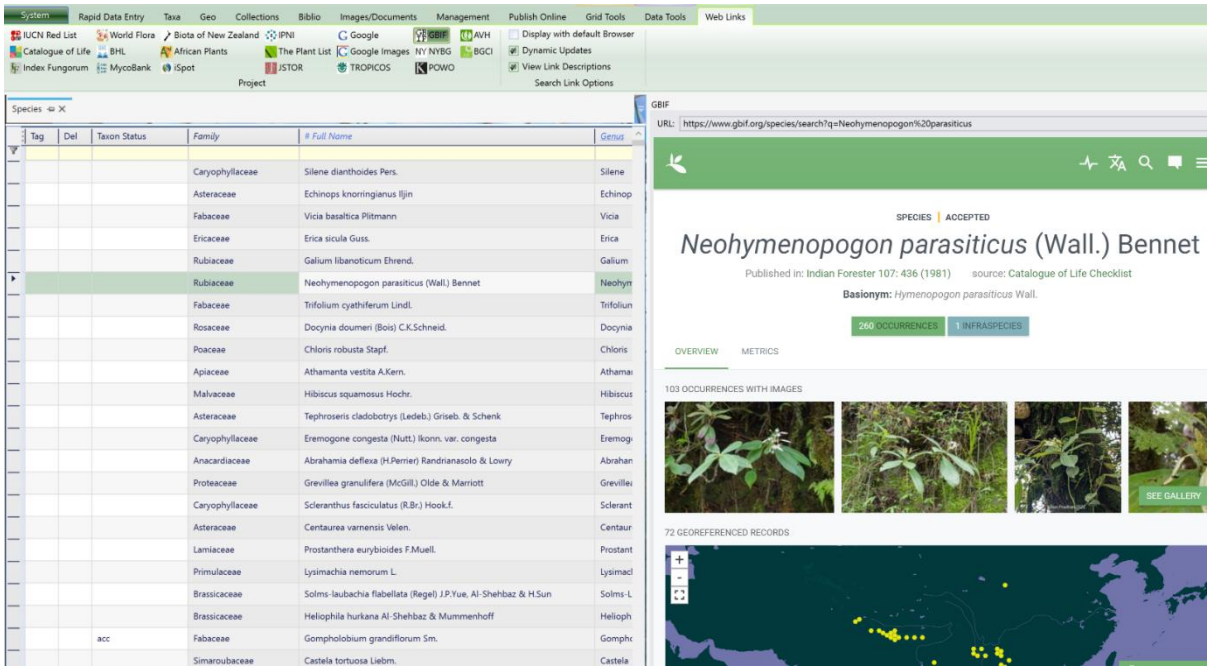
The Dynamic Weblinks tool includes the ability to import and export weblinks. New projects can thus import a useful default start up list of dynamic weblinks – and you can share your weblinks with other projects. **Download a useful sample list of weblinks**. To import the entries from the up-zipped download, select Management > Manage Weblinks...> Import...and then, as prompted, locate the .bwl file downloaded here. Highlight the weblink entries of interest then Import.

Weblink examples

- Select **Taxa > Species** to open the main species table.
- Select **WebLinks** and choose one of the available weblink options.

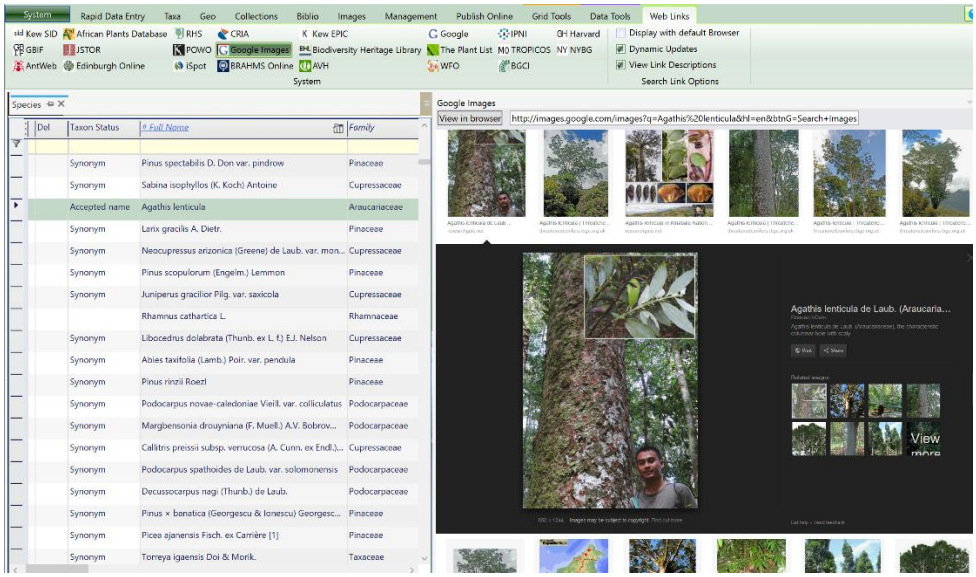


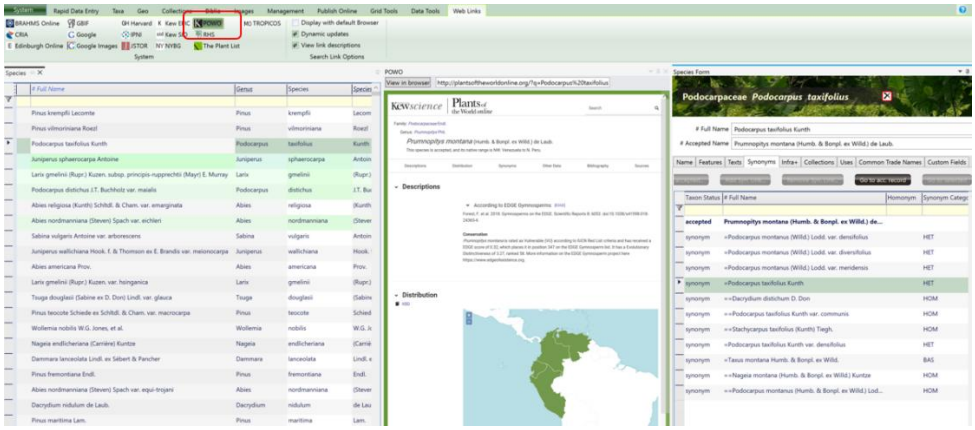
An example using the above added WebLink



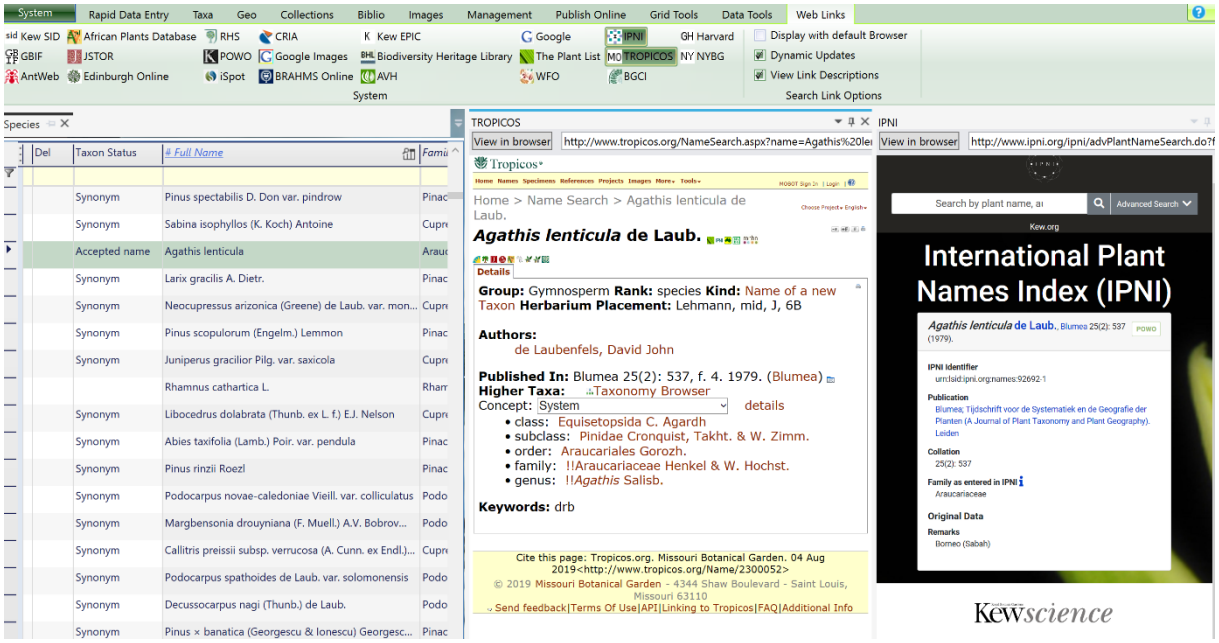
Another example using a dynamic link to GBIF.

Some further examples follow:

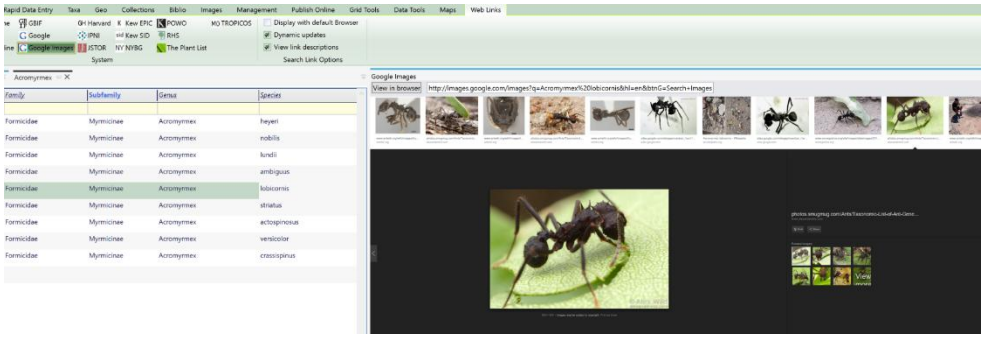




In this example, the POWO website has been opened on Podocarpus taxifolius, a synonym of Prumnopitys montana. Moving data grid records auto-updates the open weblink page. The species form is opened on the synonyms tab and the various windows are docked.



An example with 2 weblink sites opened at the same time. Linked weblink windows can be dragged to different monitors.



Example with the ant genus Acromyrmex on Google Images.

Biblio module and Literature

Introduction

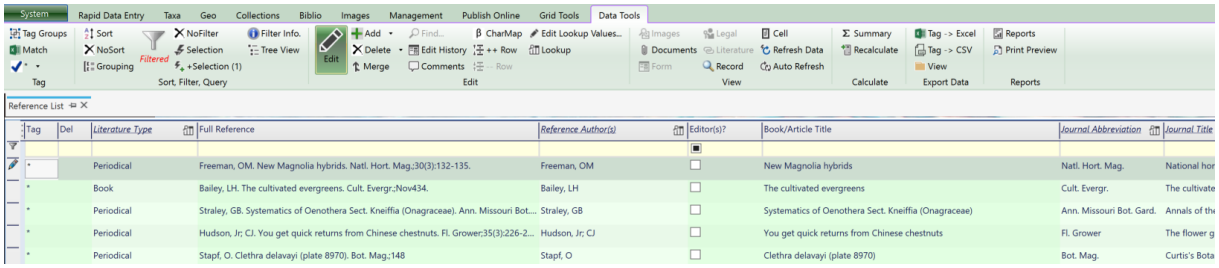
You can store references of any category (books, journal articles, websites, etc.) and then link these to any record in your database. For example, you may want to link a book, a book chapter, a report or journal article to a species or to a selected text entry for a species.

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

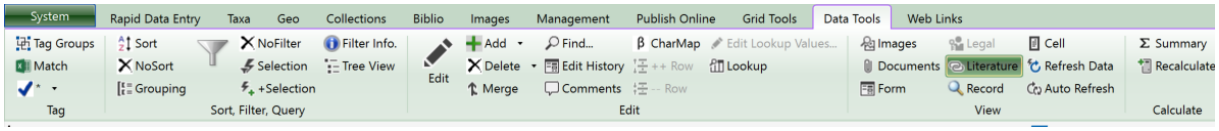


Viewing reference entries in the main literature table.

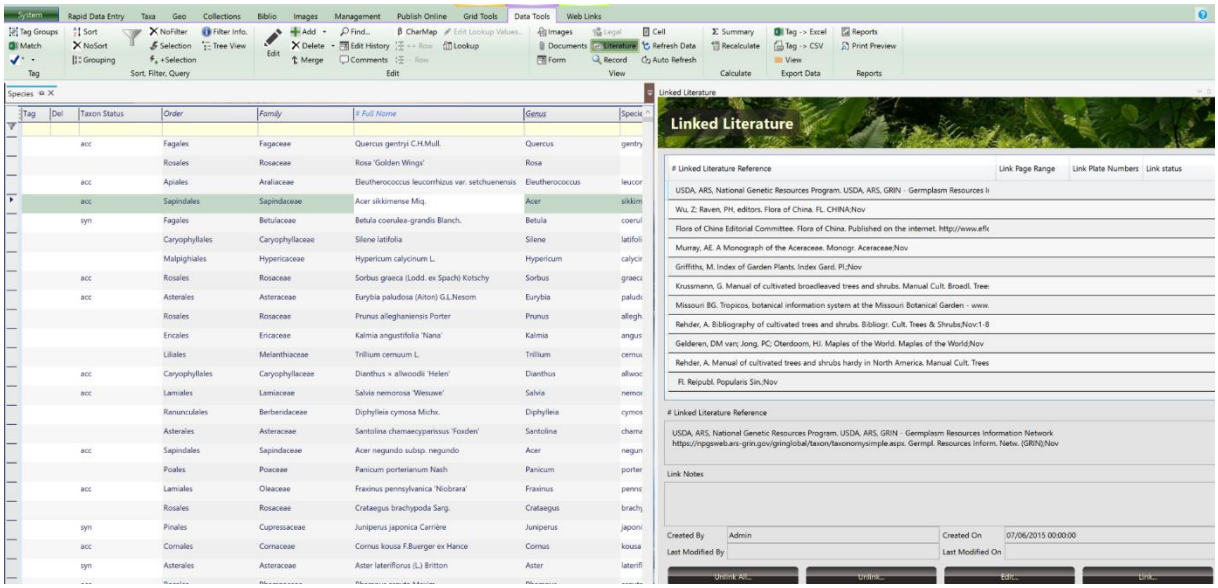
The Full Reference field can be used to quickly add a complete reference string – without needing to add data to the separate fields – although data added to separate fields provides greater control. The Full Reference field is auto-updated from the other fields IF an entry is made in the TITLE field.

Linking literature entries to data

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



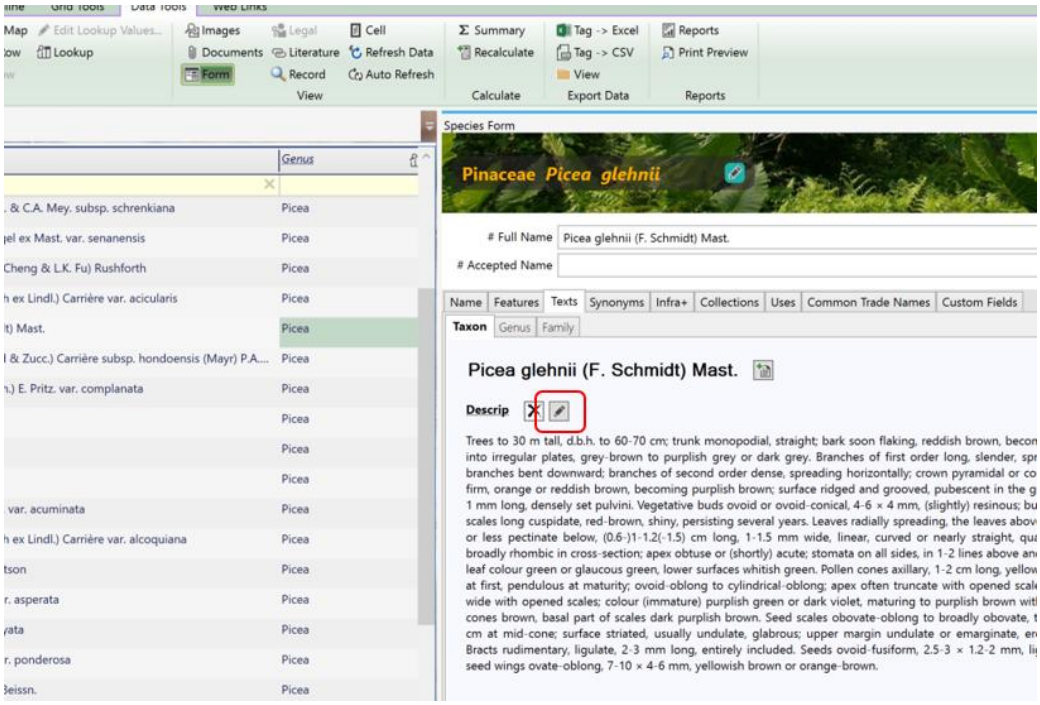
This option allows you to select any item from your main literature list and link this to the current record. You can link multiple literature links to any record, optionally adding the relevant page/plate numbers, the link status (for example 'Synonymy') and comments.



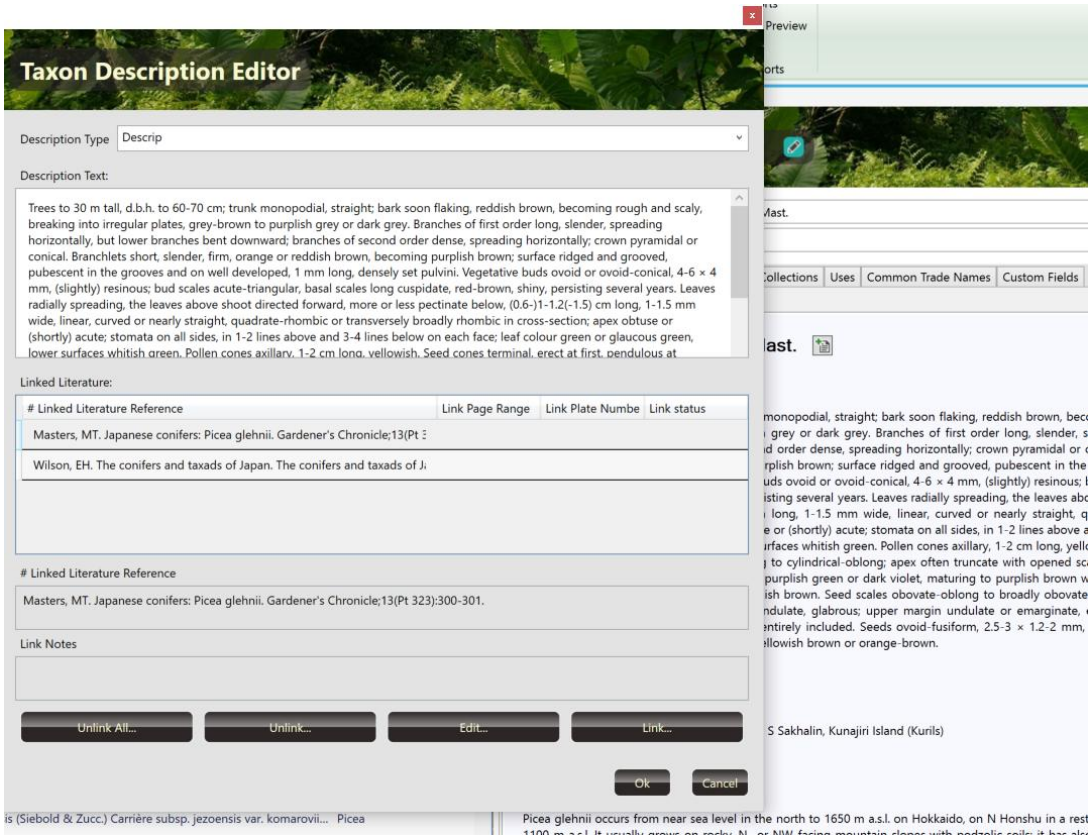
An example showing the Literature link option opened. This option lists all existing links for the current record and allows you to add/remove links.

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.

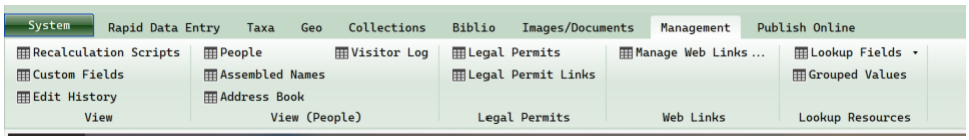


The species form Text option – with the edit option in use. Here, you can add/edit the text entries as well as linking literature entries.

Personal names and authors

Introduction

Under the Management menu, you can find options for managing the centrally used tables for People, Assembled name strings and the Address book. The section explains the use of these 3 tables within BRAHMS.

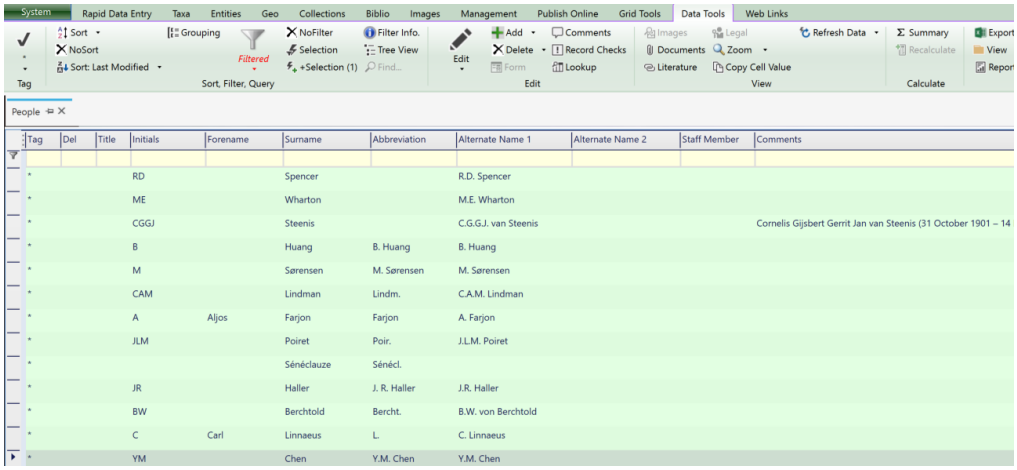


Management menu name/address options

People table

The people table is opened from **Management > People**. You can add names to this table individually, filling in fields as available. This table is used to store names of people such as collectors, taxa and reference authors. It is also used to store taxon author abbreviations.

The people table itself is a **stand-alone table**. It has no relations to other tables in the database. Thus, names here can also be deleted with no impact on the rest of your database. You can develop a clean list of people names and use this list to help construct assembled name strings (see below).



Fields such as Title and Forename are optional. When storing taxon authors, the field Abbreviation must be added. Other fields such as Staff Member can be added and have their uses for filtering.

As this table is stand-alone, you can safely delete any entries with no impact elsewhere in the database. The main function of the people table in BRAHMS is to help you create assembled name strings – as discussed below.

Assembled name string table

Introduction

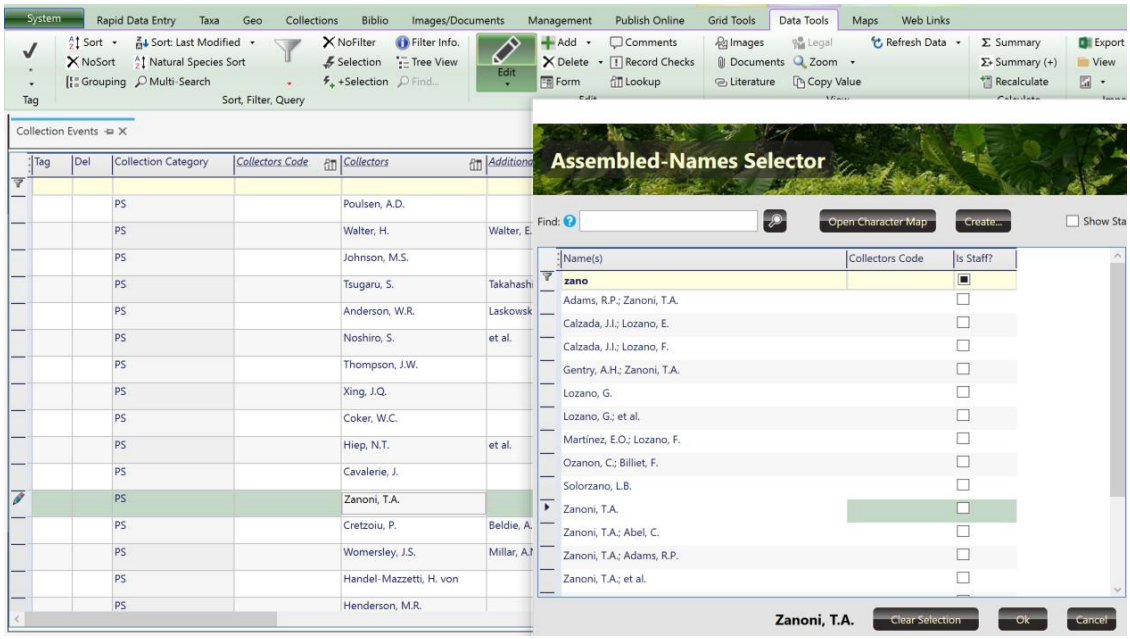
The assembled name strings table is opened from **Management > Assembled name strings.** This list is effectively used as a lookup list for names and name combinations. It is used for the following lookups: Collectors, Additional Collectors, Determined by names, Taxa authors and Reference authors.

Recent changes to table relations in BRAHMS mean that, as with people names, you can safely delete assembled name strings without having an impact on the assembled names as stored in BRAHMS. This is because all text is stored in the tables themselves. This has been done to simplify table relations in BRAHMS.

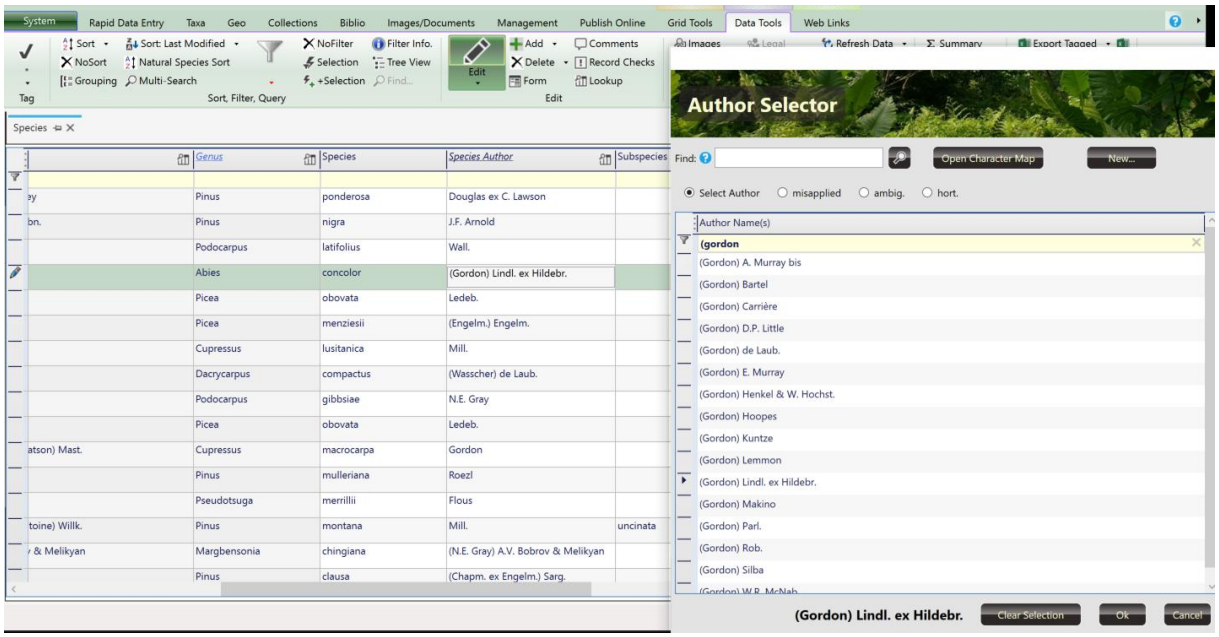
Looking up assembled names

When you are adding or editing, for example, a collector name or a species author, use the lookup tool to open the Assembled-Names Selector. If the name or name combination for not exist, you have a number of options:

a) You could simply type the new collector or author name into the table you are working in.
b) You could decide to register the new name or name combination in the assembled names table.



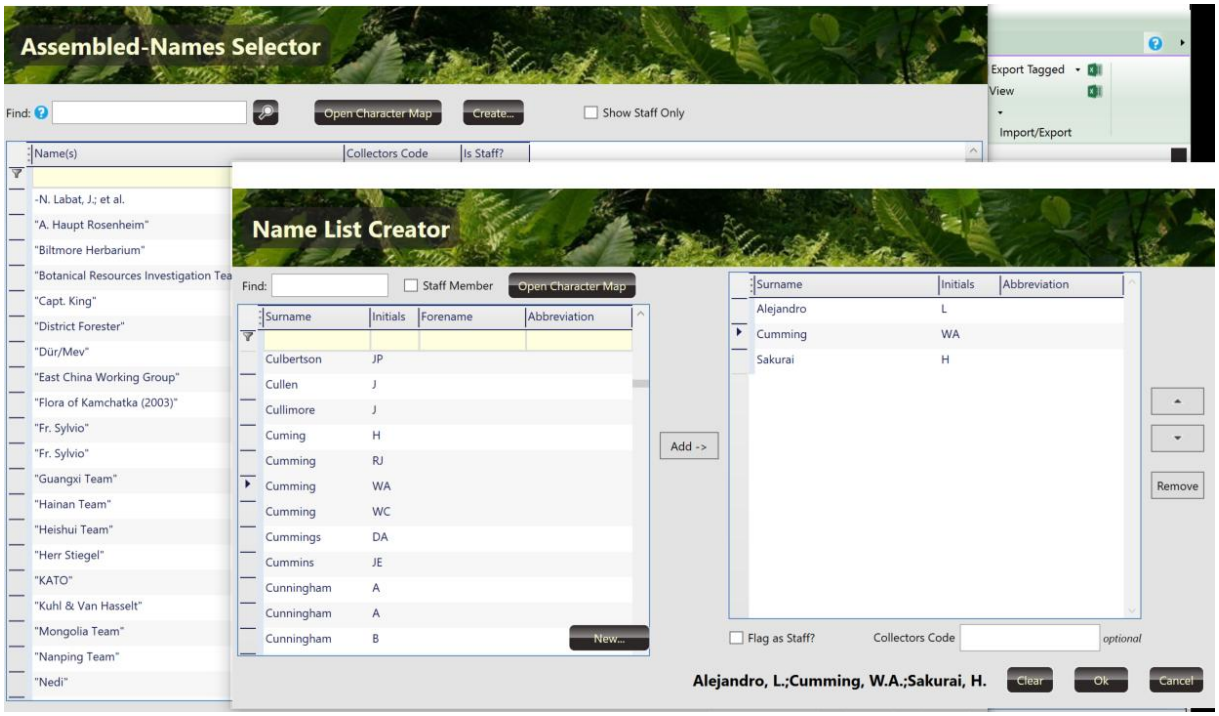
An example looking up a collector name. In this case, the name wanted is available in the assembled name list.



An example looking up an author name. In this case, the name (combination) wanted is available in the assembled name list.

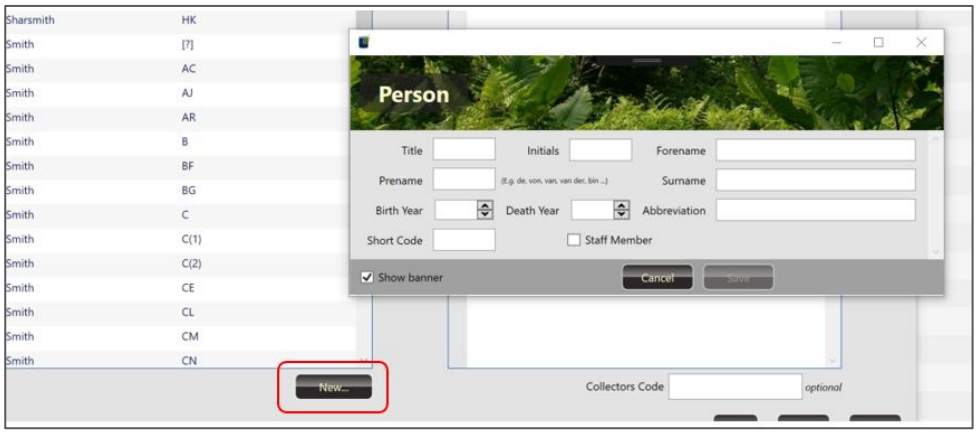
Creating new assembled names

If the name you want is not in the assembled names list and you want to register it there rather than just type it in, you can add the new name or name combination using the **Create** option



Using the Create option, you can choose names on the left panel which are listed from your People table – and add one or more names to the right panel, building a new combination.

If the person name is not registered in your people name list, you can add this:



Adding a new person from the Name List Creator form.

Taxa author names

Selecting an existing author or author combination

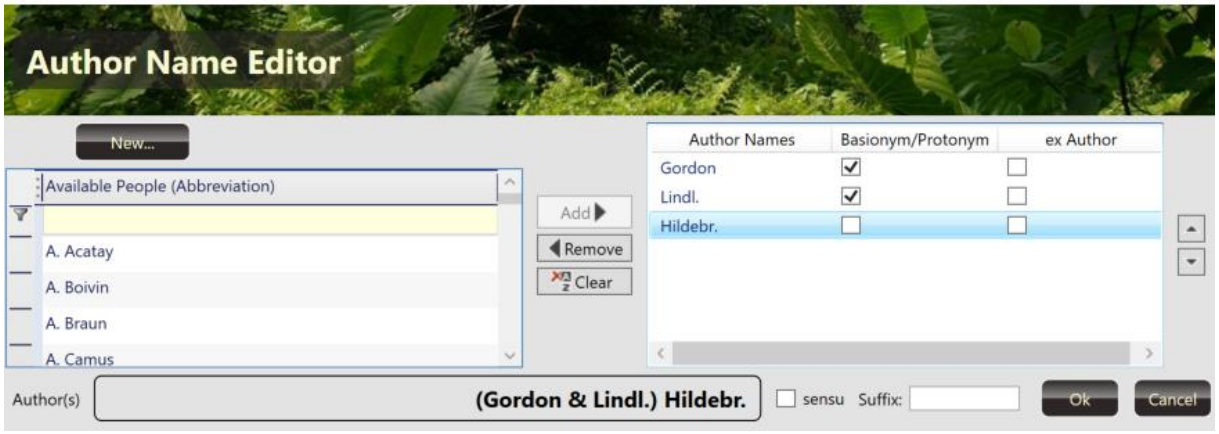
As described above, if the author string required already exists, you can locate and select this using a lookup option in the author field you are editing.

Creating and formatting new authors or author combinations

If the author name or name combination does not exist in your assembled names list, you can type it in to the author field or register this as a new assembled name entry. BRAHMS can help you correctly format complex author name combinations.



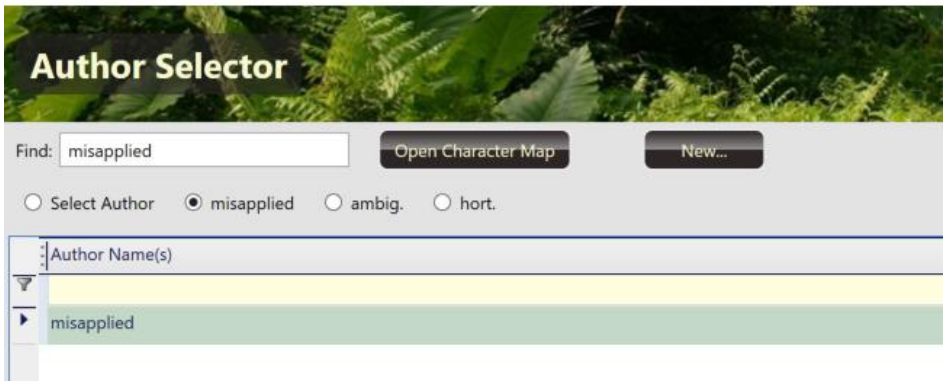
Here Gordon has been set as the Basionym author and the 'ex' option selected for Hildebr. creating the string (Gordon.) Lindl. Ex Hildebr.



Note how the string is now formatted when the authorship options are edited as above.

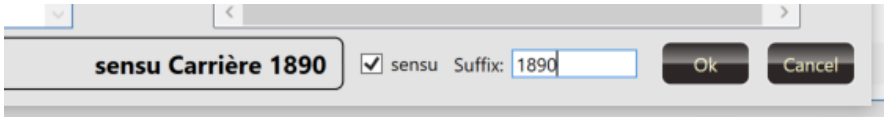
Misapplied, ambig. and Hort. Entries

Quick options are provided to select the entries 'misapplied', 'ambig.' and 'hort.' As author entries.



Using sensu and adding suffix text

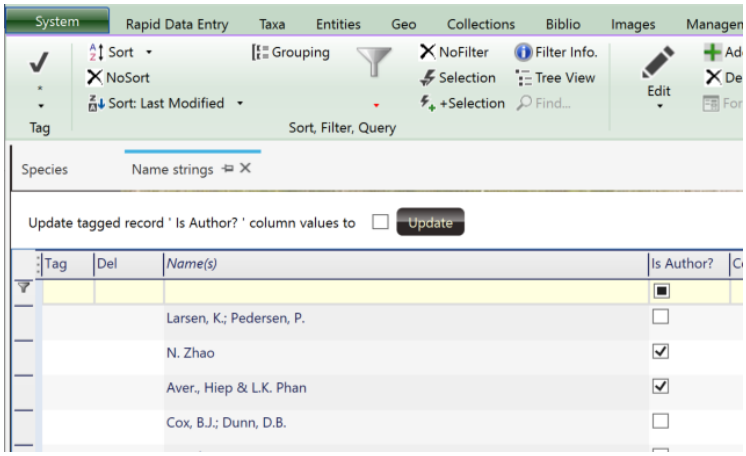
Author selections can be prefixed sensu and have a suffix added:



Use the formatting options provided to create a string such as sensu Carrière 1890.

Is Author

Note that the Assembled Name strings table has a flag to indicate whether an entry is an author string or not. This field is used to filter selections when selecting author strings.



Is Author can be updated manually of by using the option to update all tagged records.

Updating Assembled Names from the Summary Tool

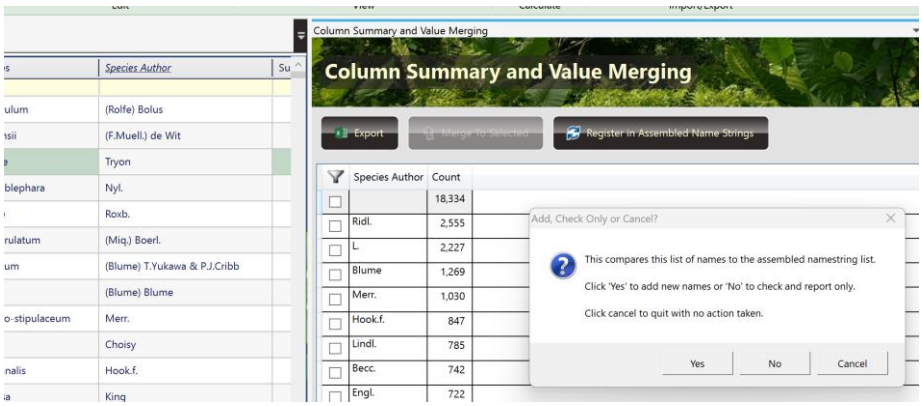
If you have collector, additional collector, family authors, genus authors, species (and infra taxa rank) authors, reference authors or detby names added to your various tables, you can check these are registered in the assembled names string table using the main Summary Tool option 'Register in Assembled Names Strings'.

The Assembled Names Strings table is a stand-alone table with no relations elsewhere. It is effectively a dictionary of names to speed up data entry using lookups. As the various names listed above (e.g. collector names) are free text strings and are often tidied up in the various tables (e.g. Collector Events), the names in these tables can be used to re-generate the assembled names table, making it more accurate for subsequent lookups.

It can be beneficial to consider doing the following clean up task periodically:

Under **Management > Assembled Names**, delete all records. This will not impact on data elsewhere in your system as this table is stand-alone. Then rebuild the Assembled Names Strings table in the following way:

- Open the main family table. Use the Summary tool in the family author field. Select the Summary tool **Register in Assembled Names Strings**. This will check and add all family authors to this table.
- Repeat the above action for genus, species, subspecies, variety, and all other author names.
- Repeat the above action for the Collection Event field Collectors and Additional Collectors.
- Repeat the above action for Determined by names in the Det history table.
- Repeat the above action for Reference authors in the main literature table.



In this example, this option will check that all author names for the species epithet are registered in the Assembled Names Strings table.

A closer look at taxa and related data

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

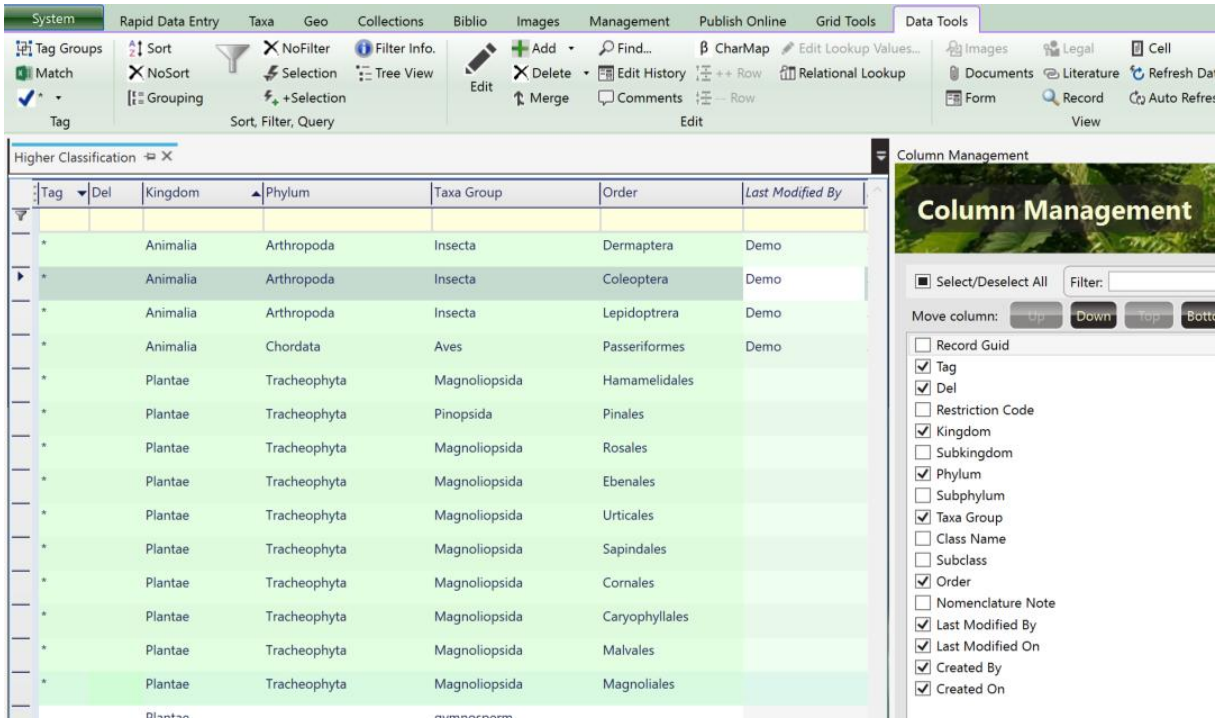
Introduction

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

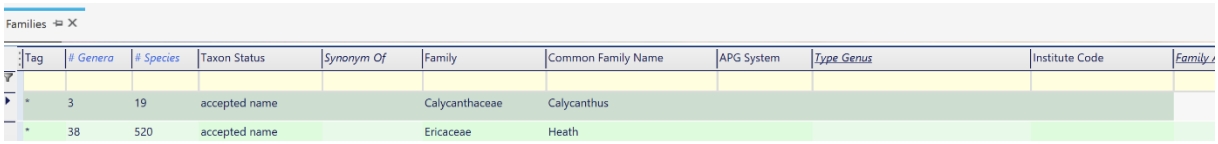
The higher classification table, by default, stores taxa names from Kingdom through to Order. Further taxonomic levels can be added as custom fields.



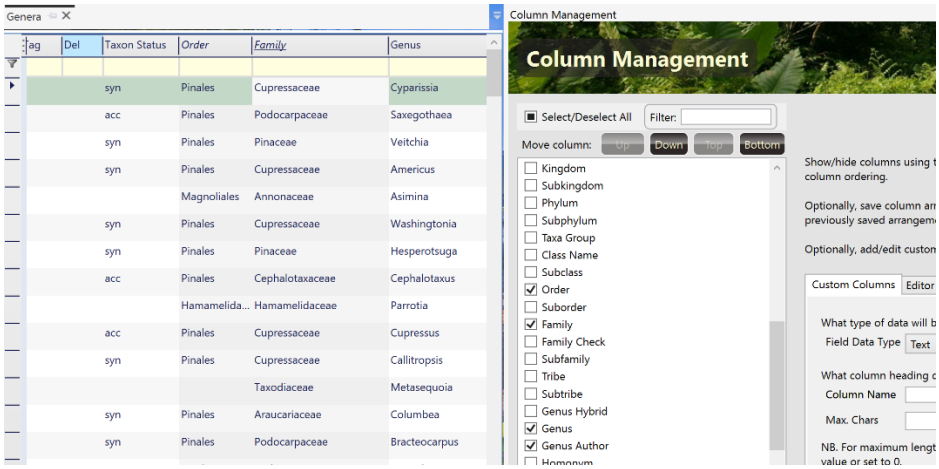
You can define further custom higher classification taxonomic levels as needed for particular taxa groups.

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.



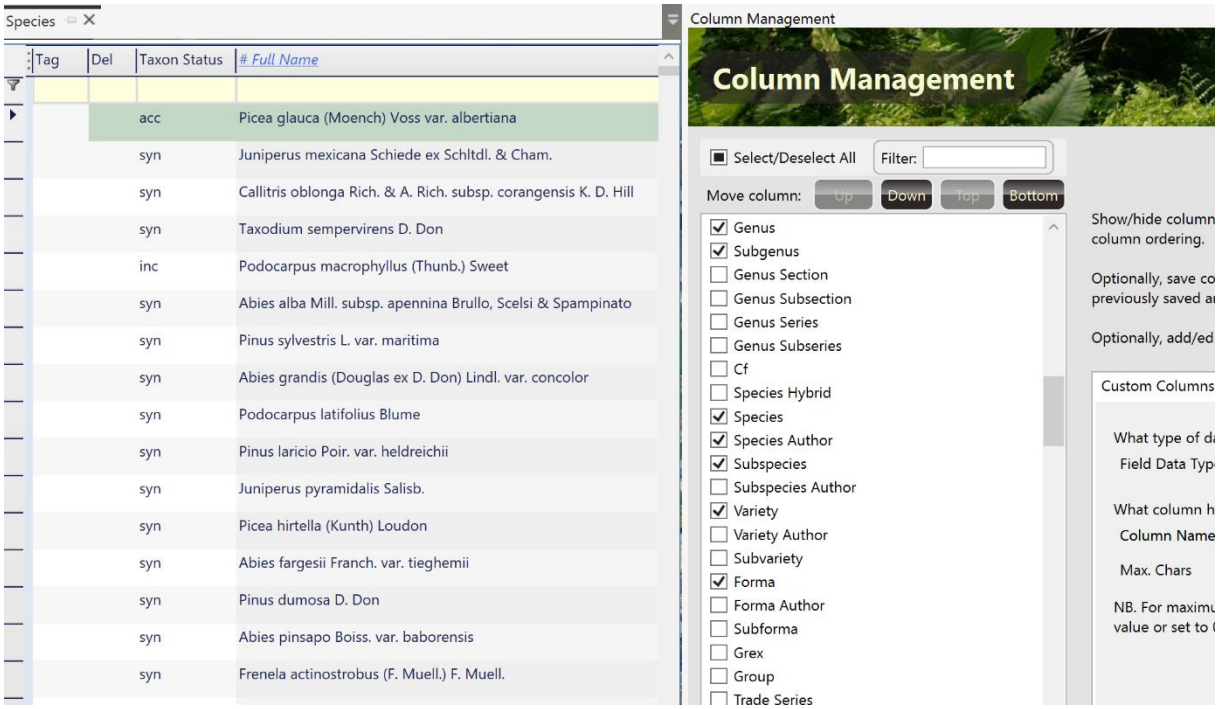
Institutional codes such as the family and genus herbarium codes can also be viewed in the species table. For taxonomic projects, families and genera may be assigned types and may have synonym links. These tables also have various *calculated fields* to display totals for linked collections, images, 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.



A selection of fields available in the main species 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, family and genus tables.

Multiple Classification Systems

Introduction

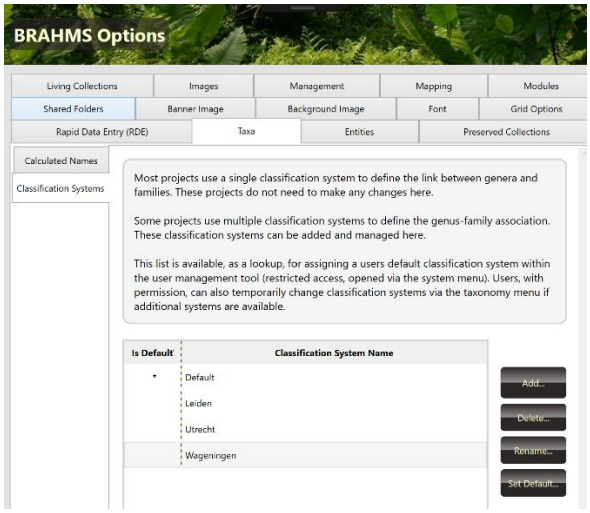
You can implement 'multiple classifications' for family genus relationships in BRAHMS. This makes it possible to link a genus name to more than one family. There is no limit to the number of classification systems that can be adopted. This feature was initially developed in BRAHMS v7 with Naturalis (Netherlands) and has now been incorporated into BRAHMS 8. This approach may be required by herbaria where there is more than one family-genus system in use. In the case of Naturalis, the herbarium consists of a merger of the previously separated Leiden, Utrecht and Wageningen herbaria where the genera were curated under different family names.

All databases have a default system known as 'Default'. Most projects will not need to adjust this or add any further classification systems. However, for some, it may prove useful for curation and/or for publication purposes, to cite genera under different family names.

Adding a new classification system

New family-genus classification systems are added using **System > Options > Taxa > Classification Systems**. Using the **Add** option, you can add a new system and assign this a name. In databases with a large number of genera, this process may take a few minutes to complete.

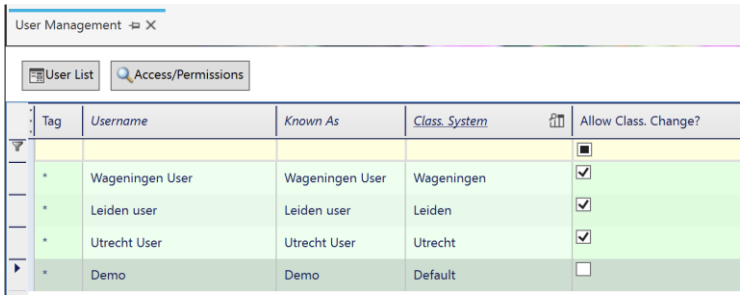
When you add a new system, behind the scenes, the 'family-genus' table is updated with copies of all genus names, initially linked to the default family name.



If using multiple classification systems, you can choose one as the default for all users. Otherwise, the default entry (named 'Default') is used.

Assigning a preferred classification system per user

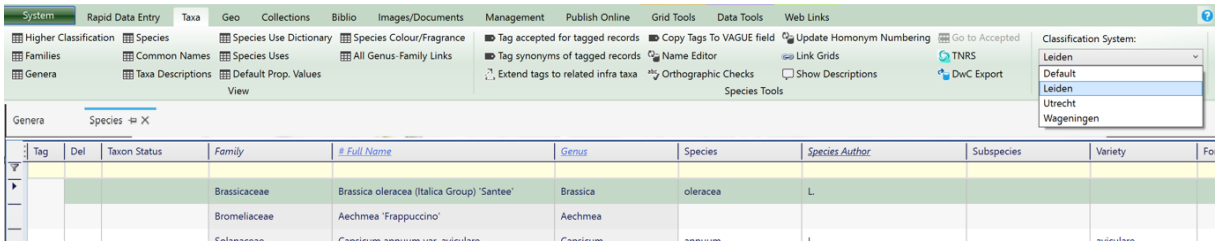
In the user table, opened using **System > Manage Users & Permissions,** you can assigned each registered user a default classification system. This system will be used as that user's classification system through the system. Note that you can also set whether a user may switch to a different classification system when logged in.



The user table allows you to set the classification system used per user and whether they can switch systems or not.

Switching classification systems

The main Taxa menu includes a dropdown menu listing the available classification systems. Users, with permission to do so, can easily switch system. The selected system will remain in operation during the log in session unless changed. When the user logs in again, that user's default will be selected.



Selecting/switching classification systems when logged in.

Note that when a classification system is selected, data will appear in the selected family-genus system throughout BRAHMS.

Browsing all family-genus links

By selecting **Taxa > All Genus-Family links**, you can review all links, using filters as appropriate. You can also edit the family name for the selected genus.

Editing Family-Genus links

There are 2 ways to edit family-genus links:

- In the main genus table, use the standard lookup for the family. This will set the family name for the selected genus for the user's currently selected classification system.
- In the main family-genus table, you can adjust the family name for a genus in the selected classification.

Deleting a family or genus

When you delete a genus name, this will remove the name under all family classifications.

When you delete a family name, this would delete any genera linked to that family name – as well as any data associated with those genera. Thus, if you have a family name that you wish to delete, make sure that there are no general linked to that name in the family genus table.

Importing taxon names via RDE

When importing RDE files for taxa or any other data that have taxon names (*e.g.* herbarium specimens or plants), if a new genus/family name is added, this will be added for all classification systems. You would then be able to edit the classification as appropriate for newly added genera.

Finding names and using taxa lookups

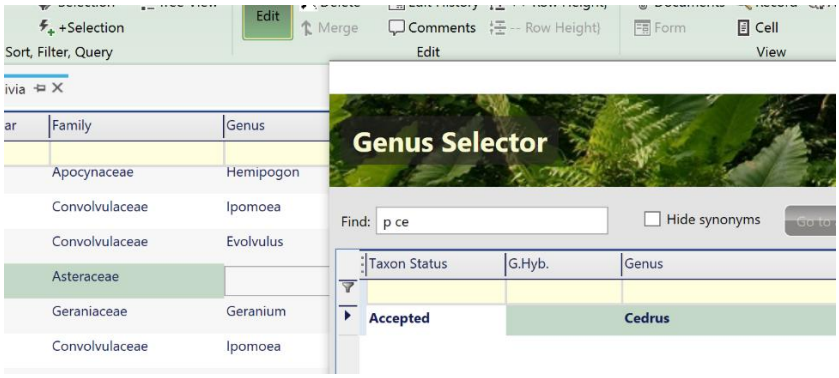
Family names



Family lookup.

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 or double-clicking on the selected record selects the family at the top of the list and adds this 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.

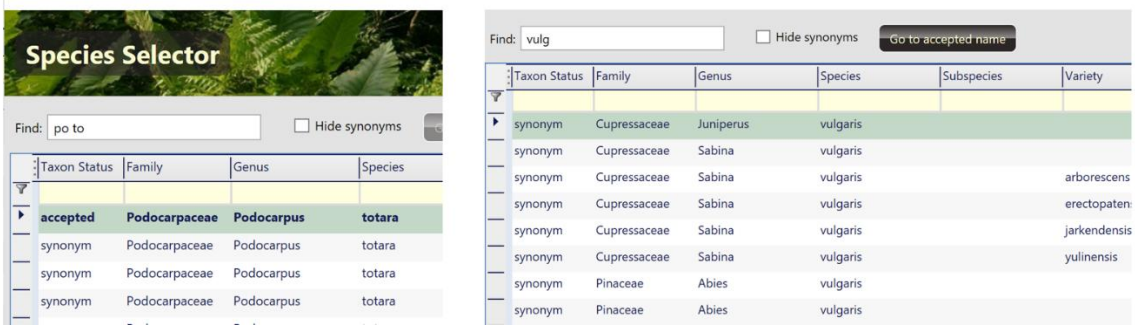
Genera



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 or double-clicking on the selected record 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



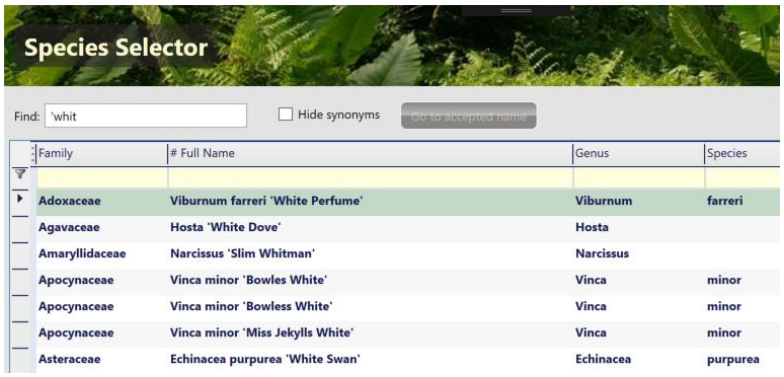
Species lookups – you can add a few letters of the genus and species epithets to locate the name quickly.

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.

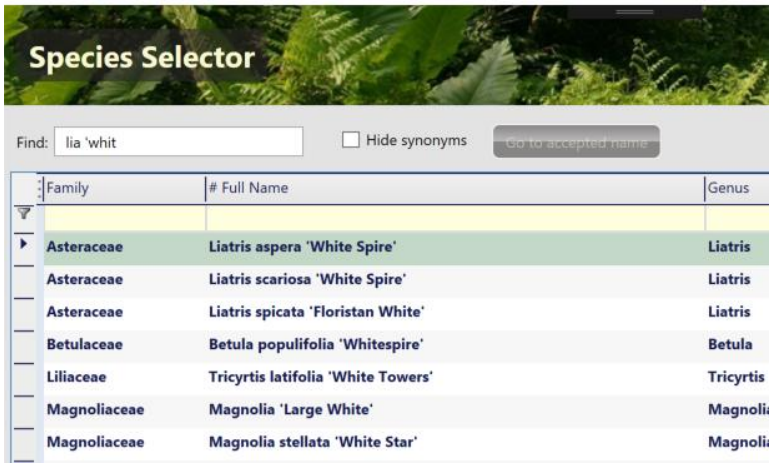
As these data are hierarchical, if you know the species, it is not necessary to use a lookup in the family or genus field as the species lookup will add data to all these fields as well as higher classification.



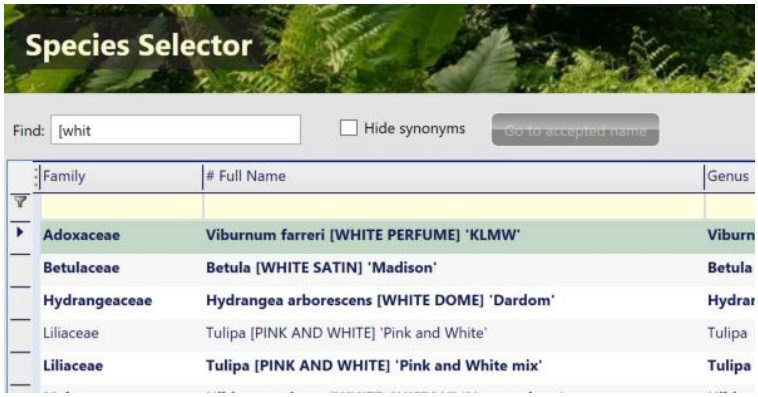
Entering parts of name epithets, as shown above, can locate a name quickly



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 include [whit

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.

Editing a species author name

For further details on this process, refer to the name strings section on Editing taxa author names.

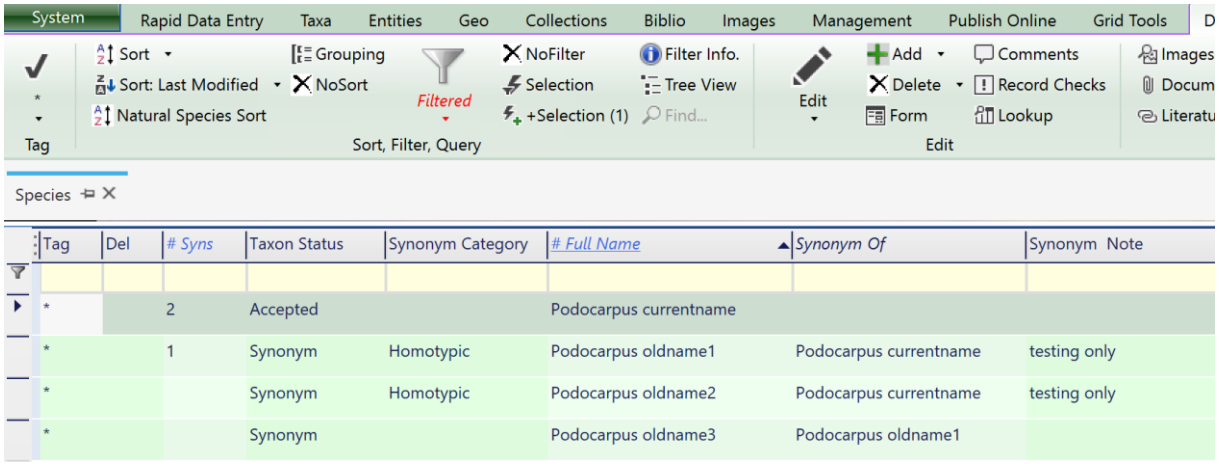
Author name abbreviations are stored individually in the main People table. However, the author name compilations that link to taxonomic names come from the 'Assembled name strings' table. Both tables can be opened under the **Management** menu. Authors of taxa may consist of formatted combinations of 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.

Synonyms

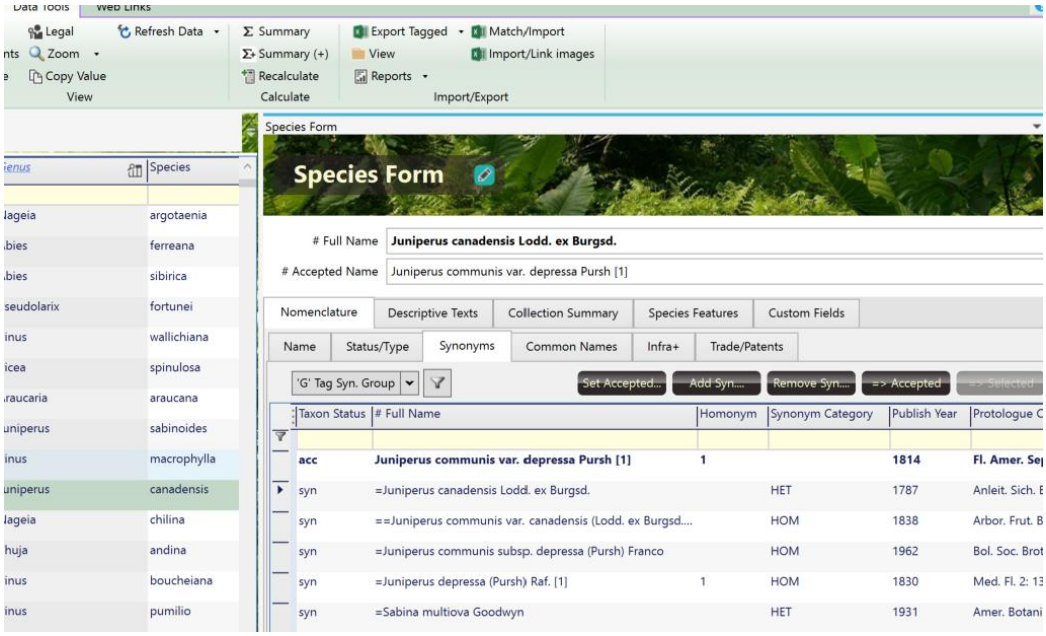
A name may have one or more synonyms. Synonyms may, optionally, be marked with an appropriate taxon status (e.g. Syn or Synonym) and be assigned to a synonym category (homotypic, heterotypic, basionym as examples). The calculated field #Syns shows the total number of synonyms linked to a name.

The easiest way to make one name a synonym of another name is to use a lookup in the field *Synonym Of*.



In this example, Podocarpus currentname has 2 synonyms. The name P. oldname1 also has 1 synonym linked.

Synonyms can be also listed and edited from Synonyms tab on the species form.



*Synonym links can also be edited from the **Synonyms** tab on the species form.*

Using the 'G tag Syn. Group' option, all taxa records in the current synonym group are tagged 'G', regardless of any filters you may have in place. The adjacent Filter option will filter the main taxa grid to G tagged records. You may use this option to tag multiple species synonym groups. The drop down on the 'G tag Syn. Group' option provides additional option to clear G tags for the current synonym group or for all G tagged records.

Further details about synonyms can be added to the text fields Synonym Note and/or Nomenclature Note.

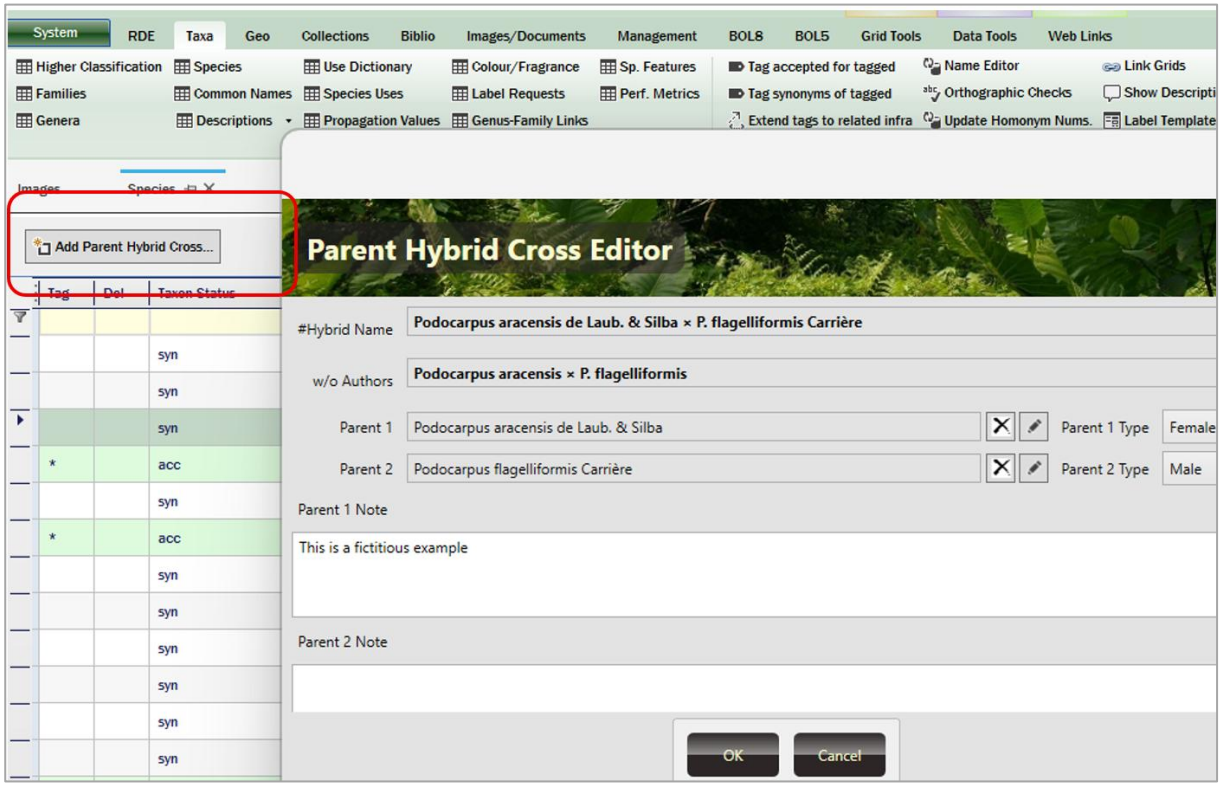
Hybrid names and formulae

As of BRAHMS 8.7.4, in the main species table, you can add and calculate hybrid taxon names and hybrid formulae based on parent taxa. While BRAHMS has always had the facility to add 'hybrid names' (nothotaxa) using the hybrid symbol embedded in a name (Genus × epithet), you can also explicitly link 2 taxa records, optionally indicating the parent status, to create hybrid formula names. The parent names must already be stored in your species table.

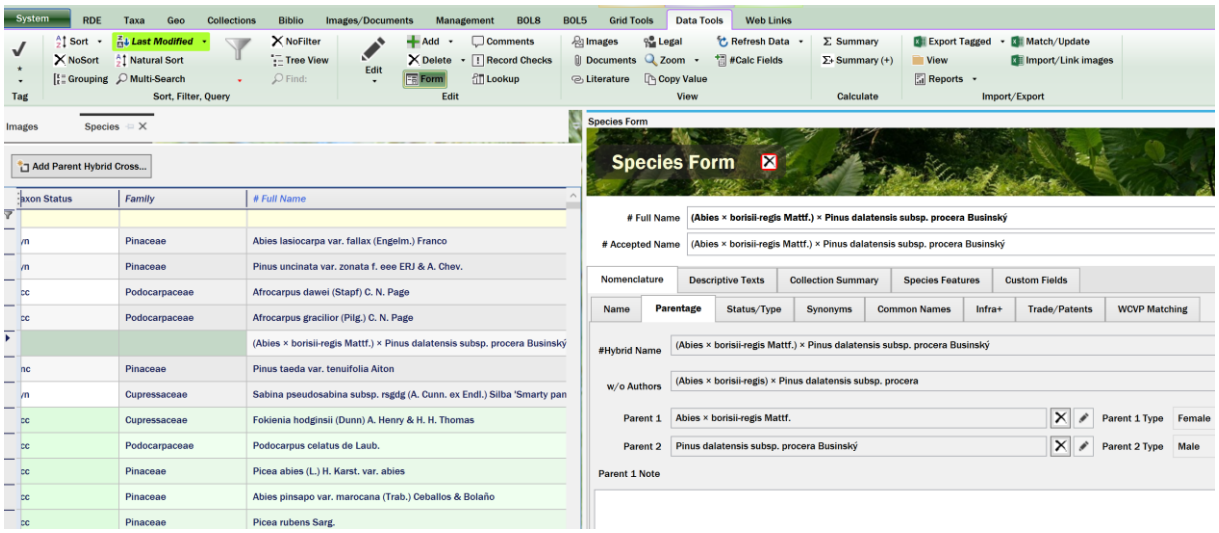
As the parents themselves may be hybrid names or formulas, these name formulae can become complex. Formula names are auto-calculated by BRAHMS and are treated like any other name for management purposes, for example, linking the formula name to collections.

Some examples calculated within BRAHMS:

- (*Rhododendron* 'Catawbiense Grandiflorum' × *R. yakushimanum* 'Koichiro Wada') × *R.* (Elizabeth Group) 'Elizabeth'
- ((*Rhododendron* 'Bambi' × *R. proteoides*) × *R.* 'Mindy's Love') × ((*R. 'Bambi'* × *R. proteoides*) × *R.* 'Naselle')
- *Phalaenopsis* Cherokee gx 'Zuma Canyon Gertie' × *P.* White Chiffon gx 'Zuma Canyon'
- *Sarracenia psittacina* subsp. *heterophylla* × *S. purpurea* subsp. *purpurea* f. *heterophylla*
- (*Brugmansia* × *rubella* 'Mobisu') × (*B.* × *rubella* 'Wildfire')
- *Magnolia* 'Ian's Red' × *M. sprengeri* var. *diva* 'Eric Savill'
- *Gladiolus carmineus* × *G. orchidiflorus*



Use the Add Parent Hybrid Cross option to add a new entry.



Hybrid taxon names and hybrid formulae can now be edited from the Parentage tab on the species form

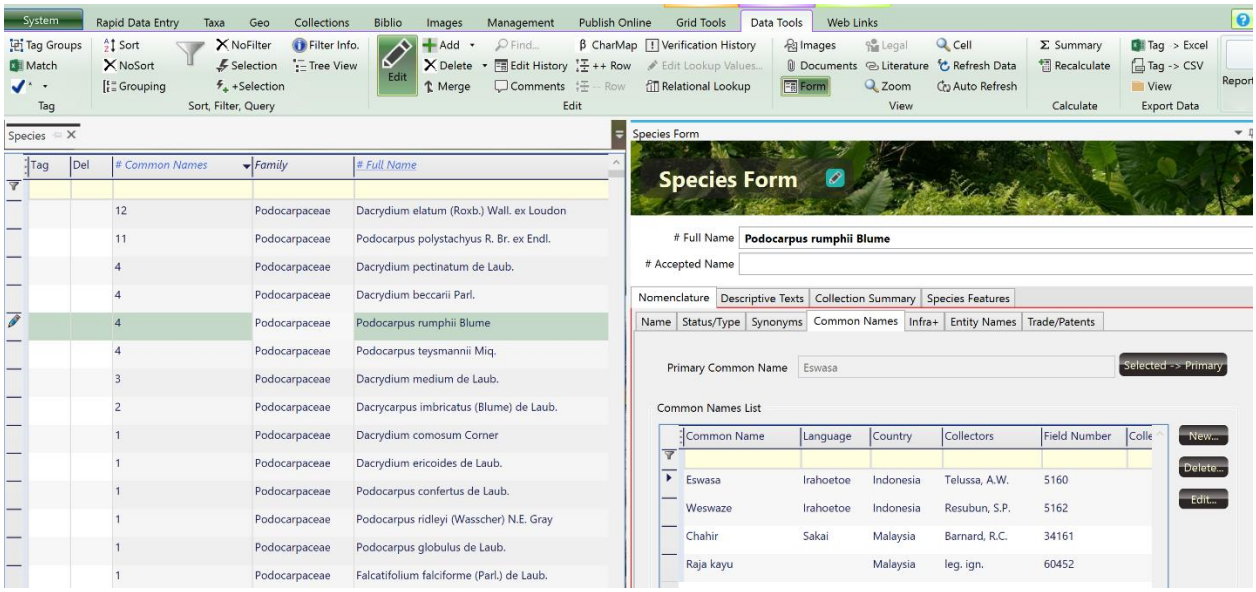
The relevant fields in the species table, also viewable in the data grid, are:

Parent hybrid name
Parent hybrid name w/o (without authors)
#Parent 1 Full Name
#Parent 1 Full Name w/o (without authors)
#Parent 2 Full Name
#Parent 2 Full Name w/o (without authors)
Parent1 Type
Parent1 Note
Parent2 Type
Parent2 Note
General Parentage Notes

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 open 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.



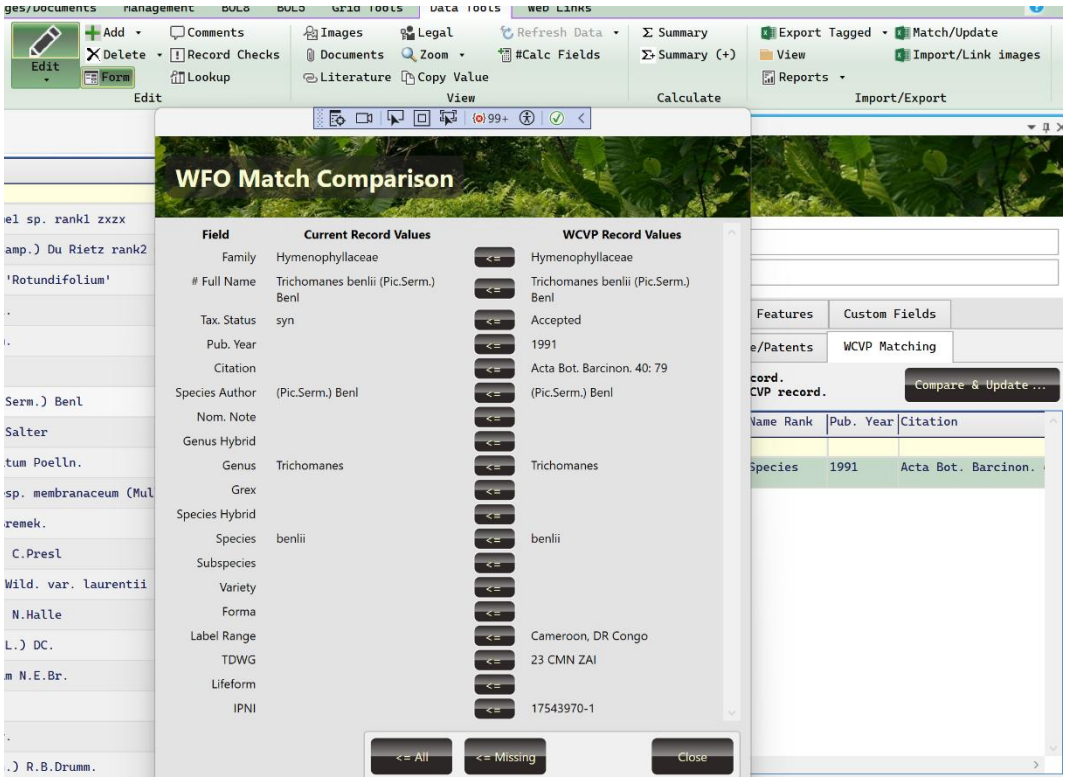
The common names table has the following structure:

Field name	Notes
Tag	Standard field for tagging records
Del	Standard field for deletion
CollectionEventId	Link to a collection event (and thus location/species)
SpeciesId	Link to a taxon name
EntityId	Link to an entity
Common name group	Names can be organised into groups
Common name	The common name
Homonym	Differentiate between identical names
Name rank	A numeric code to rank names by preference

Suppress	A flag to suppress (offensive) names when publishing
Language	The language of the common name
Dialect	The language dialect
Source	The source of the name
Etymology	The meaning of the name
Interview	Notes on interview (e.g. with local people)
Folklore	Name folklore
Comments	Other comments
GeoNote	Geographic notes (especially where no linked collection event)
Audit fields	Standard audit field (who/when added/edited)

World Check List Vascular Plants /Data Updates

From the main species form, use the WCVP Matching tab to check your names against the World Check List of Vascular Plants (WCVP). You can check/update species records against WCVP and selectively update details for taxon status, author names, protologue citation, IPNI code and known geographic distribution including TDWG codes.



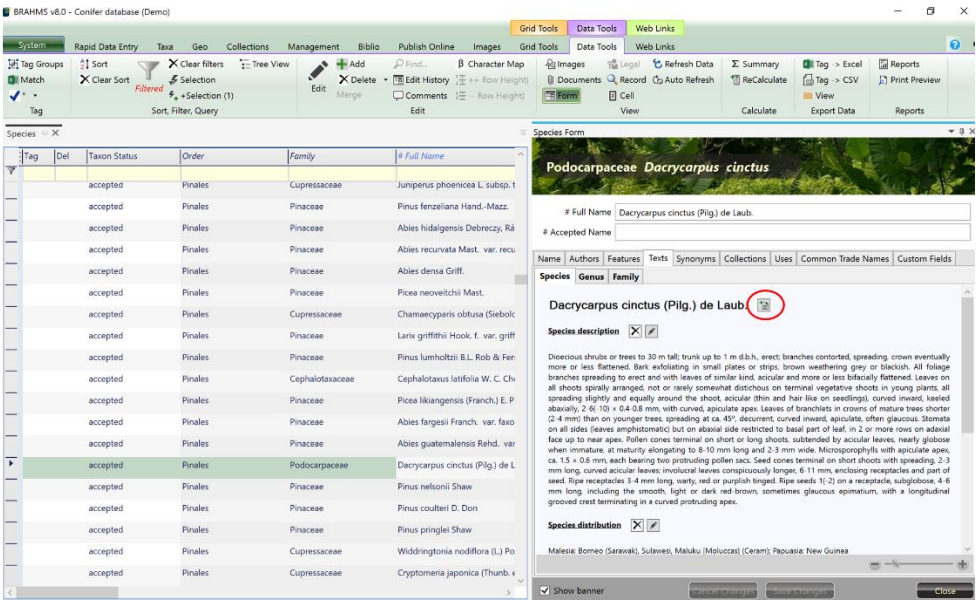
Use the WCVP Compare & Update option to transfer selected values from the online resource to your local database.

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.

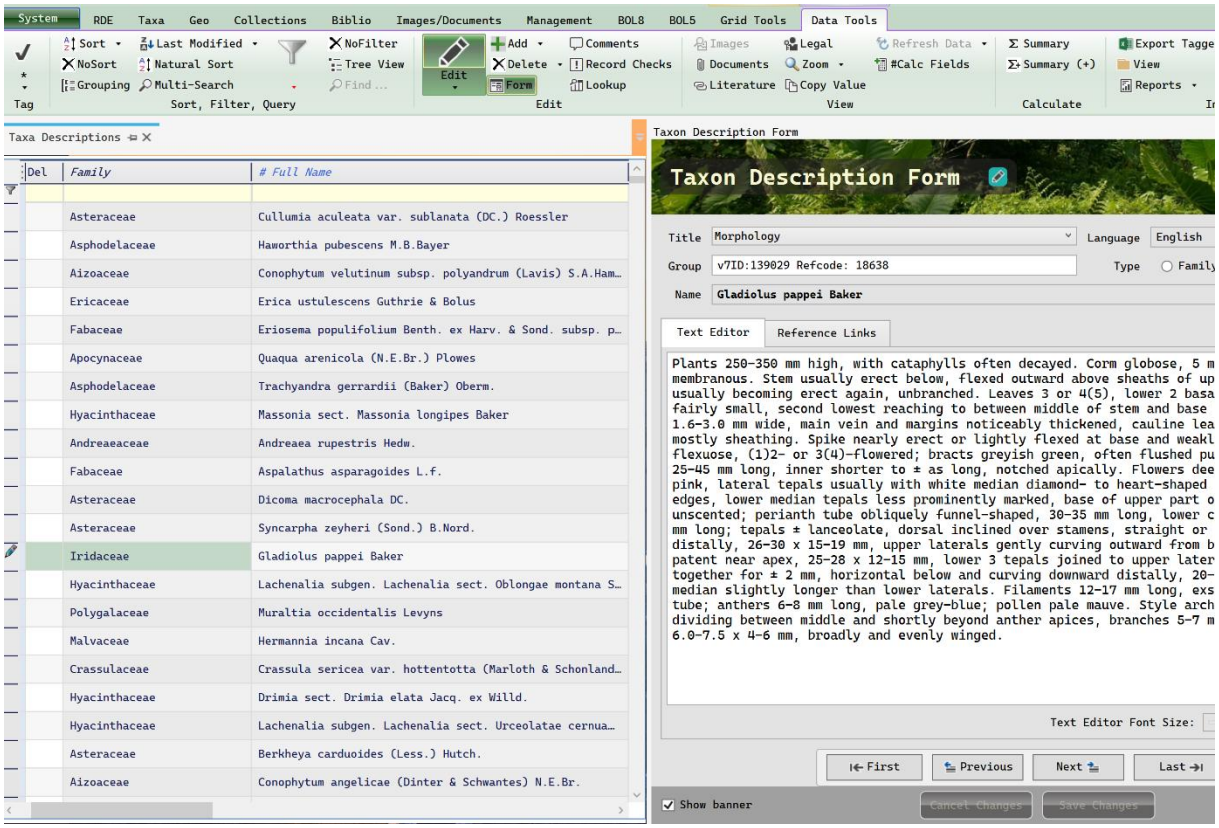
With the species form open, select the **Texts** tab. You can add new entries as well as edit or delete existing entries.



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**.

You can also add descriptions directly to the descriptions table. This table has its own form where you can add text and reference links.

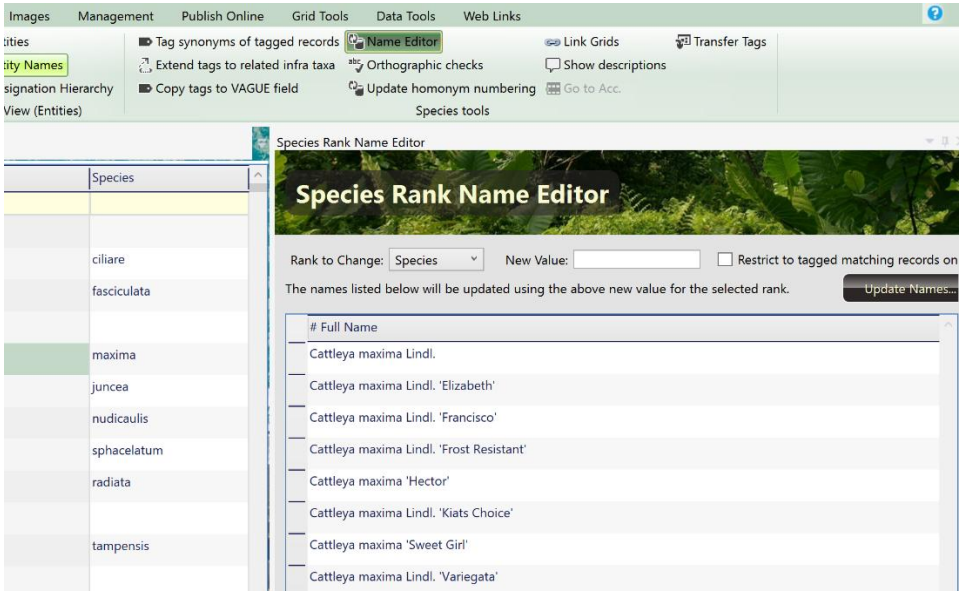


Taxa descriptions form

Further taxa options

Name editor

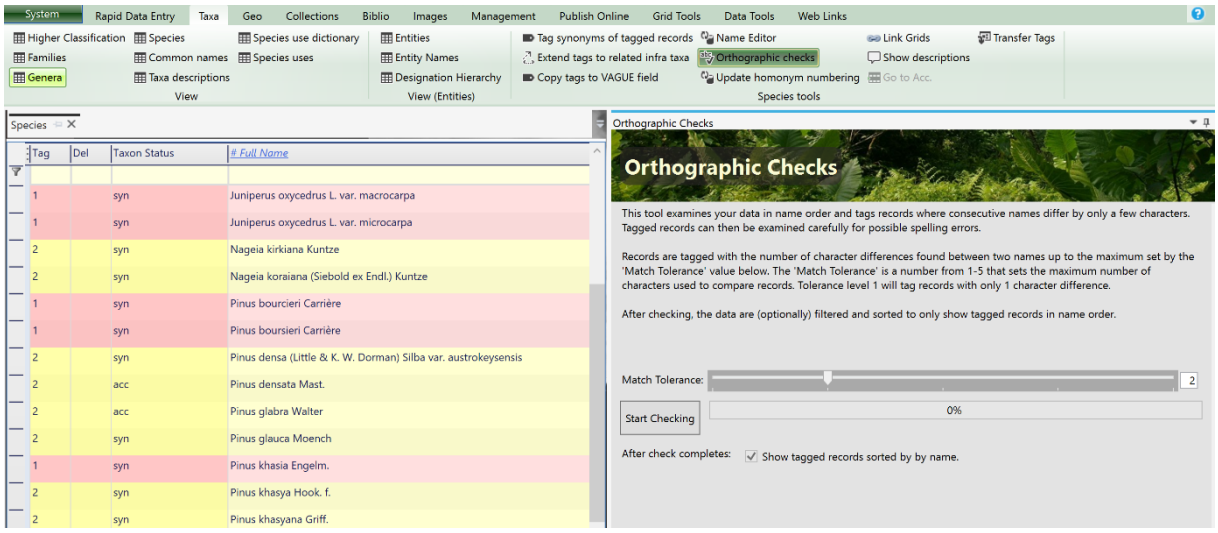
The name editor allows you to update all or tagged dependent names. For example, you may have a species named maxima in the genus Cattleya which is incorrectly spelt or has to be changed for another reason. The species may have dependent names (subspecies, varieties, formas, cultivars or ranks). This 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.

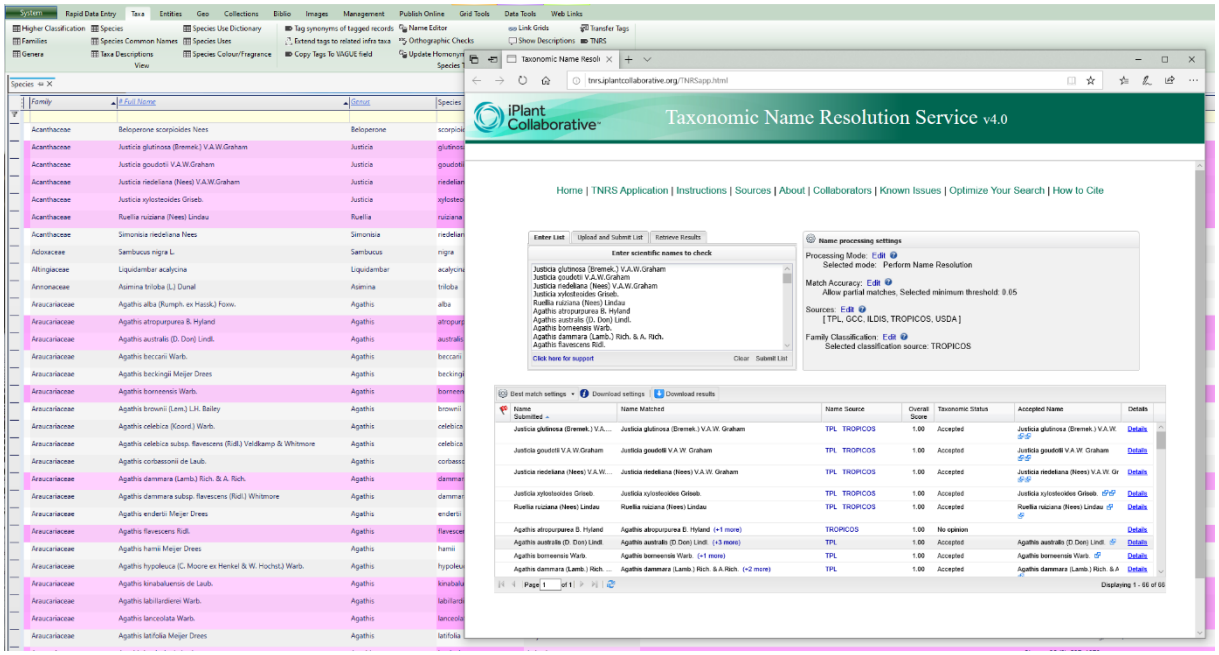


An example check showing records with 1- and 2-character differences. It is then the decision of the person checking the data if the differences are valid or mistakes.

Taxonomic Name Resolution Service (TNRS)



The TNRS service provides another mechanism to check names. His is run from the main species table using the TNRS option on the Taxa toolbar.

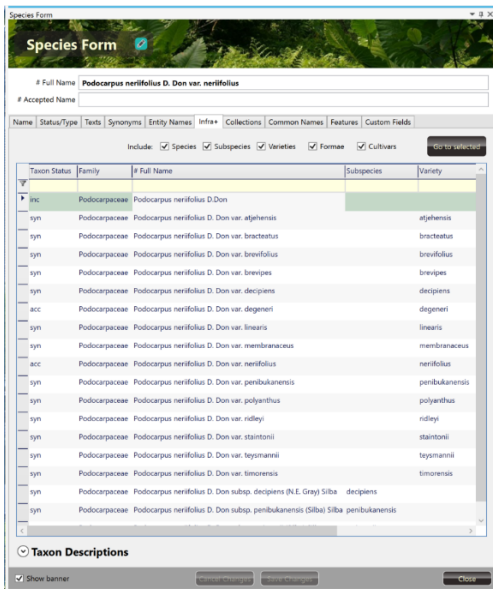


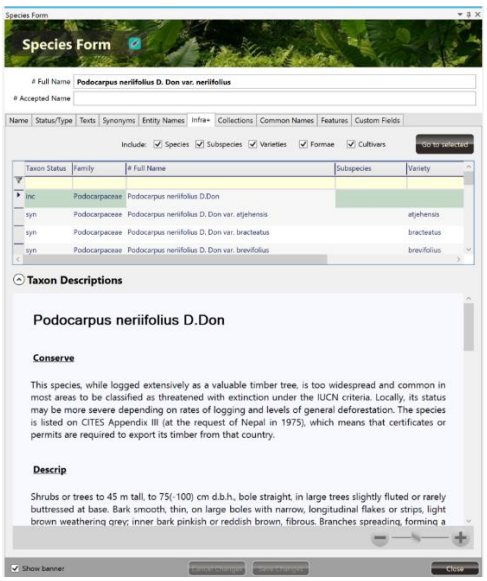
To use this option, Tag the names to check, Select the TNRS option on the main Taxa menu and copy the names from the generated BRAHMS text area into the TNRS Names to Check box.

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.

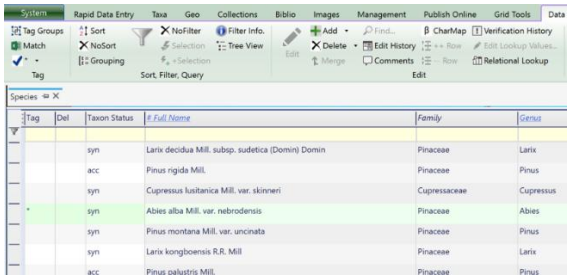




Note that you can restrict the names listed to selected ranks. The fields displayed in the grid can be adjusted using a right-click on the grid header. The Taxon Descriptions option opens any text descriptions as available.

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.



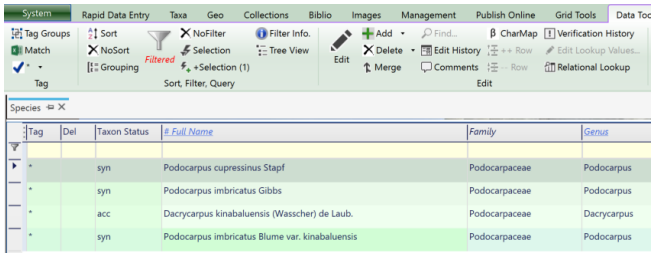


In this example, all records of Abies Alba have been tagged based on the tagged record in the left screen.

Tag synonyms of tagged records

The taxa menu option **Tag synonyms of tagged records** tags synonyms of any tagged records.





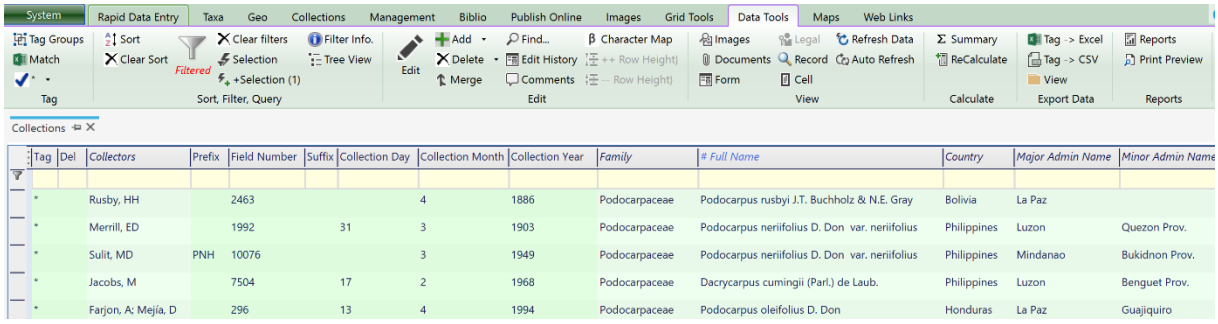
In this example, synonyms of Dacrycarpus kinabulensis have been tagged.

Collection events

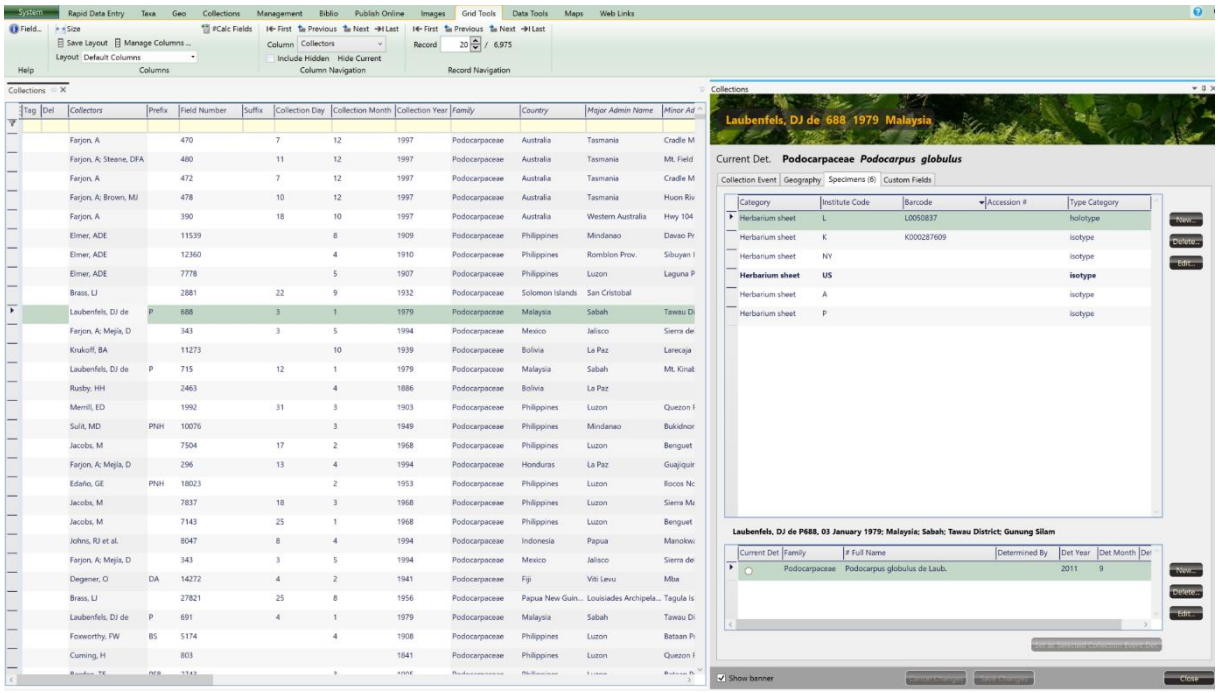
Introduction

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 (living or preserved). 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.



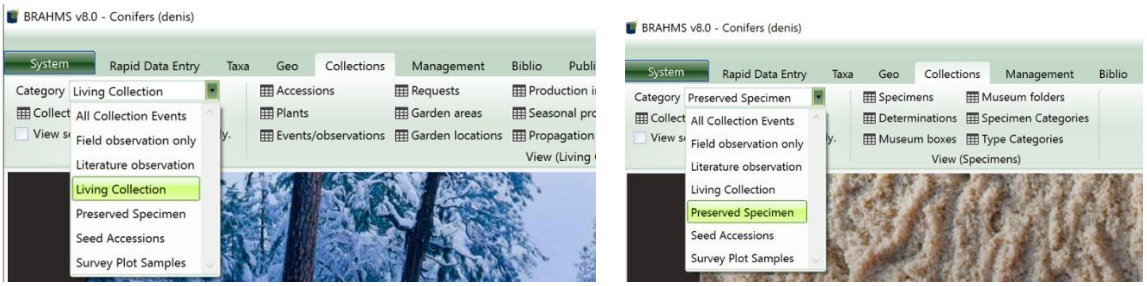
Some records from a typical events table. Events keep track of the collector(s), field number, collection date, locality as best known, descriptive text about the location, habitat and the item itself and the identification the item is known by (the 'selected determination'). You will not find an accession 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 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.

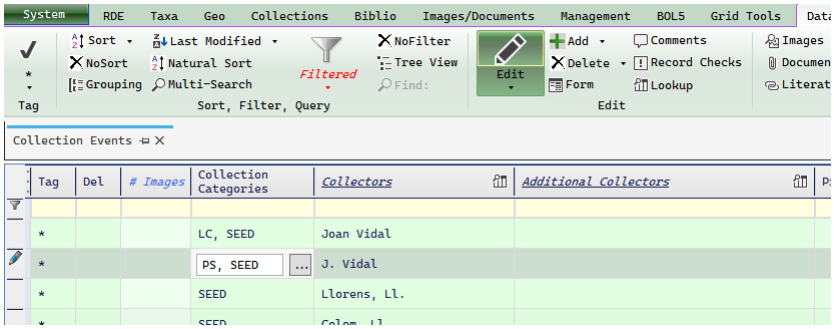


Selecting a specific collection category alters the toolbar menu options.

The Collection Category field in the Collection Events table uses a fixed list of values which cannot be edited. The categories are:

PS (preserved specimen)
LC (Living collection origin)
SEED (Seed origin)
LIT (Literature origin)
OBS (Observation)
SPS (Sample plots)

From BRAHMS 8.7 onwards, you can link an event to one or more categories using the multi lookup option. You can use find/replace to update values – but take care the values are one of those listed above. You cannot use non-standard values as the values control which toolbars are enabled. For example if an event is 'PS', it will be included when the collection category drop-down is set to Preserved Specimen. If the category is 'LC, Seed' it will be displayed if the collection category drop-down is set to Living Collection or Seed Accession. In both these latter cases, the event will refer to the wild origin of these data.



Collection Event data grid showing the category field in Edit mode.

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.

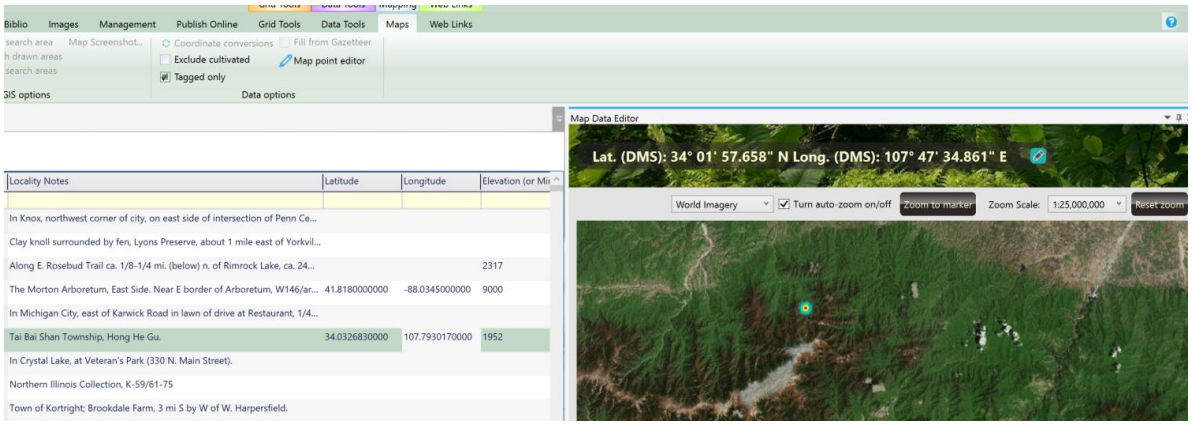
Locality names and the gazetteer table

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

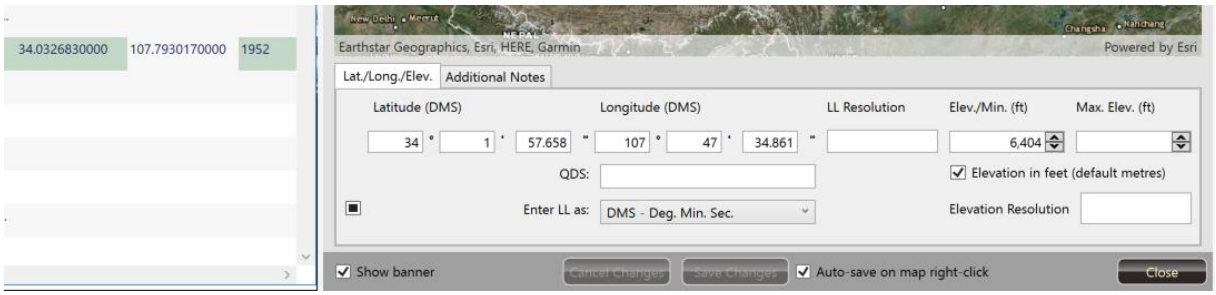
The use the map editor is discussed in the relevant map section.



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.

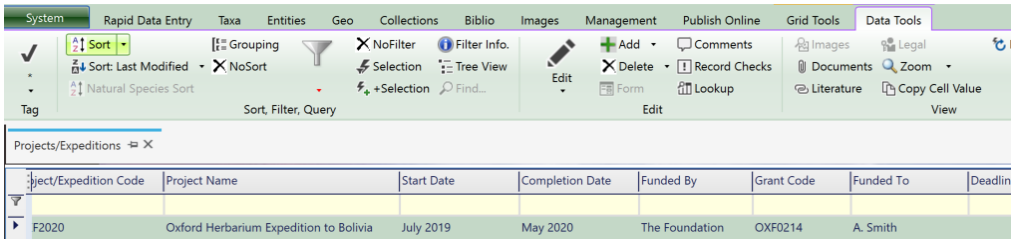
Selected determination

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).

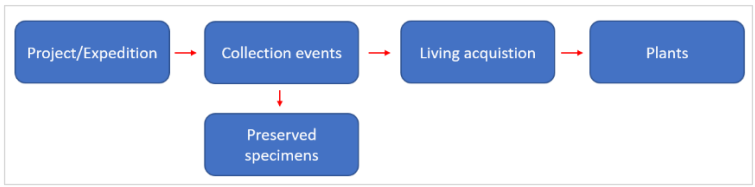
Projects and expeditions

The Projects/Expeditions table stores details on the start and end dates, funding, team members, deadlines and notes about projects and expeditions. Each entry can be assigned a short text code.

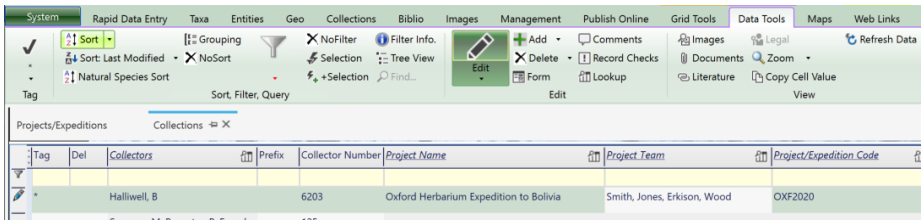
This table is mostly used to group together collections linked to a funded project - or all collections (preserved and/or living) made on a named field trip or expedition. An expedition may take place over a number of years.



Collection events can be linked to Project/Expedition records. The project/Expedition fields: Category, Project/Expedition Code, Project Name, and Team can be viewed in any table that has a relation to collection events including the Plant Accession and Plants tables.



Collection events can be linked to Project/Expedition records. They can be also be viewed in related tables including plants and preserved specimens.



Project/Expedition records are linked to collection events using a lookup on any of the relevant Project/Expedition fields.

Museum and herbarium specimens

Some of the key features

- Scalable, to manage any size of collection.
- Allows multiple users to add and edit data simultaneously, with access permission controls.
- Store data for any category of specimen.
- Store one to many physical specimens per collection event.
- Store one to many determinations per specimen.
- Add project specific fields to your database structure if these are not included by default.
- Link images to specimens as physical files or media library URLs.
- Design report templates for lists, loan forms, labels and determination slips.
- Optimize specimen data capture using the Rapid Data Entry module.
- Import specimen data donated from other databases and websites.
- Use specimen data to develop checklists and analyse diversity for differently scaled areas.
- Map geo-referenced collections to show distribution by species or any other queried dataset.
- Publish specimen details with images online.

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.

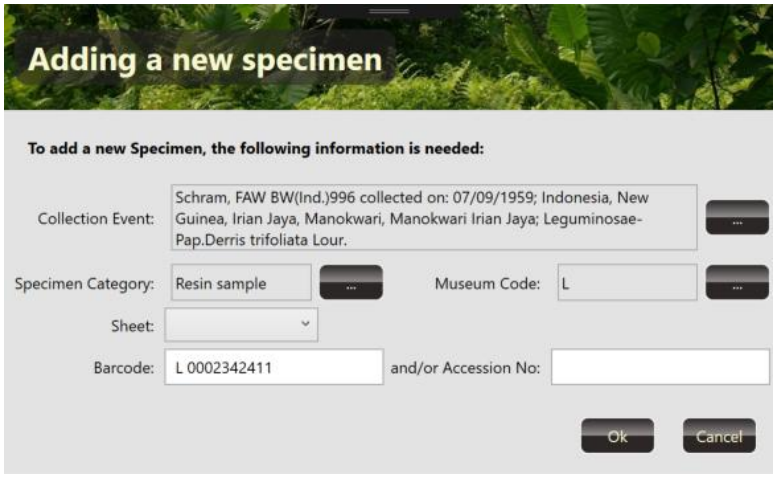
Each specimen is linked to one collection event. Many of the fields seen in the specimen table data grid are inherited and displayed from the collection events table. However, others are specific to the specimen including the category of specimen, the institute code where it is deposited, accession number, barcode and various other fields including details for type material.



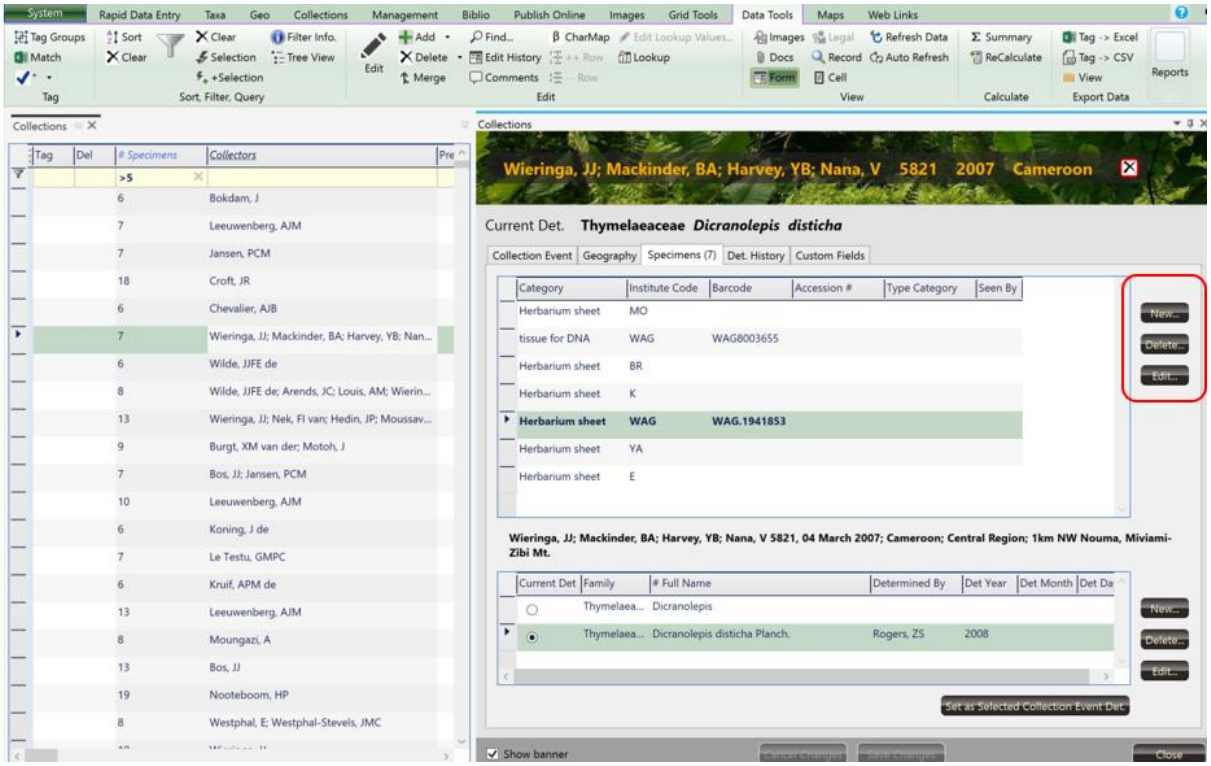
The options for specimens are available when you select the category 'Preserved Specimen' on the Collections menu.

Adding/editing specimens

Specimens can be added to the specimen table directly using the standard **Add** option on **Data Tools**.



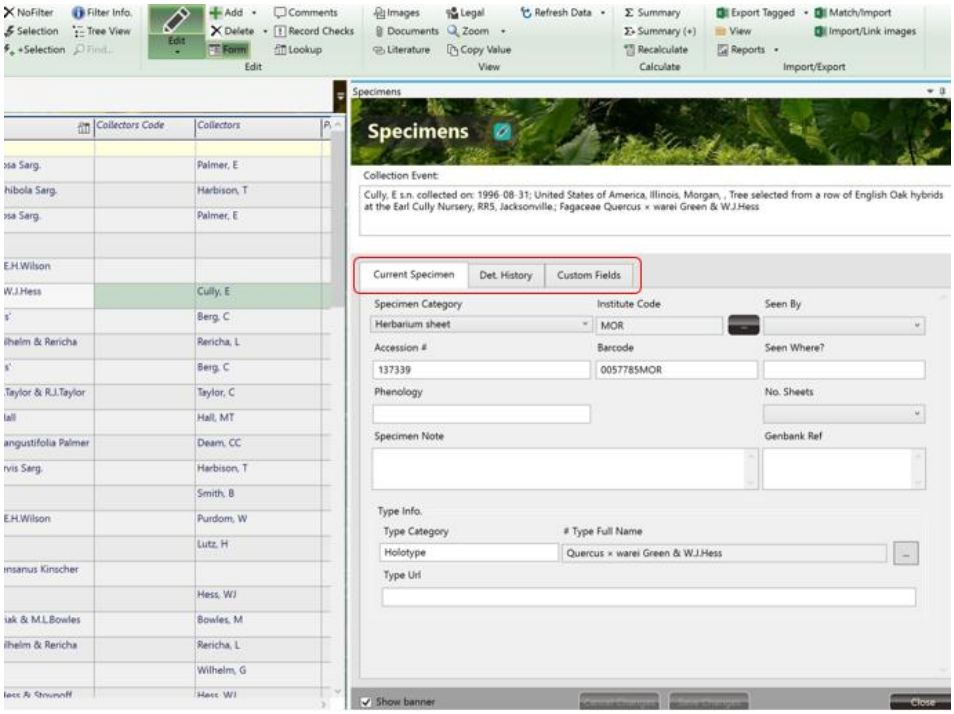
Adding a specimen directly to the specimen table.



Alternatively, you can add a new specimen when using the collection events form.

Specimen form

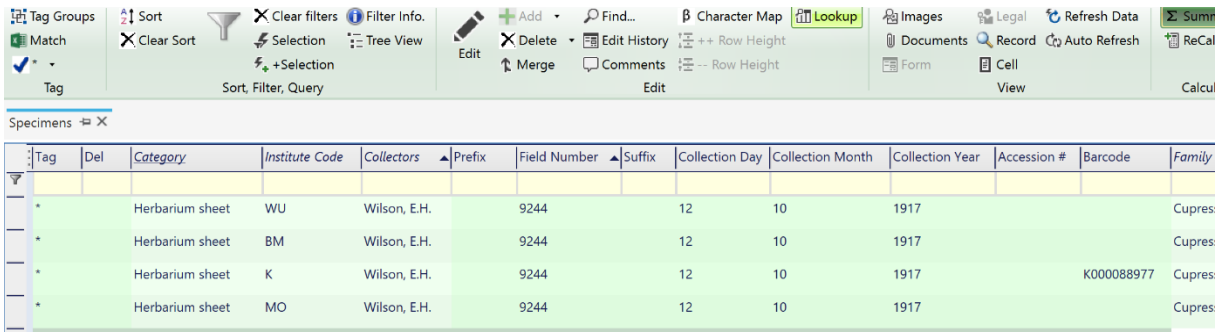
The specimen table has its own form. This can be used to add/ edit specimen records and their determinations.



The specimen form has tabs to list all determinations and view/edit custom fields.

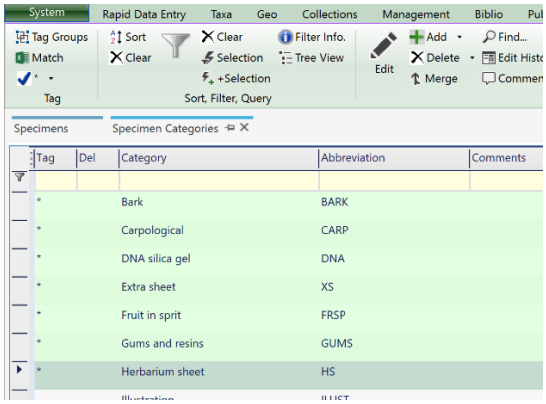
Duplicates

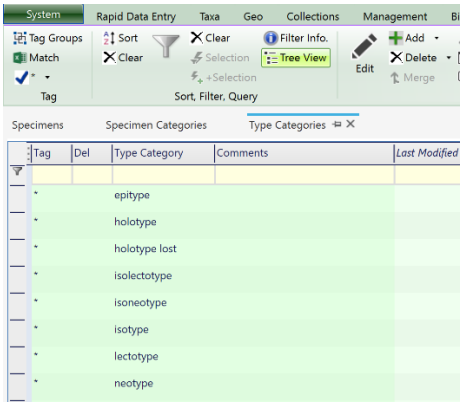
Sometimes, material is duplicated to more than one institution, especially the case with plant material. In this case, there will be two or more specimen records linked to the same collection event but with different specimen level details (where deposited, barcode, etc.). There is no limit to the number 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



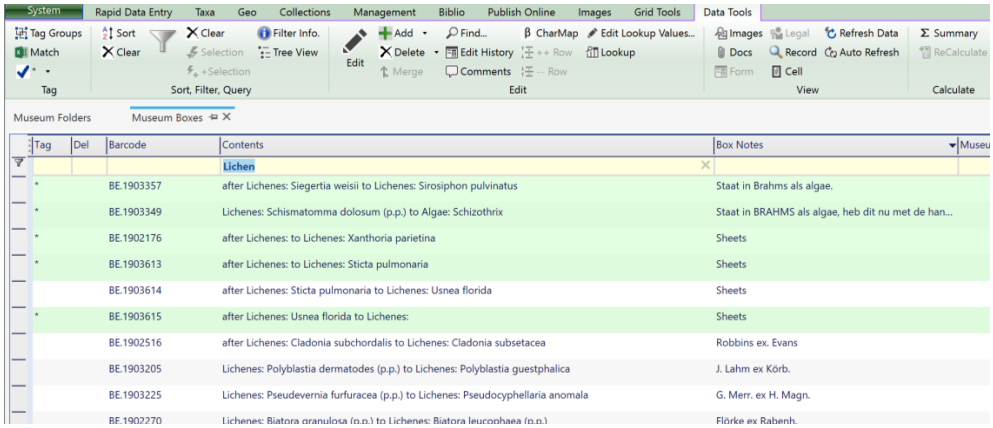


These lists are held in separate tables.

Museum boxes and folders



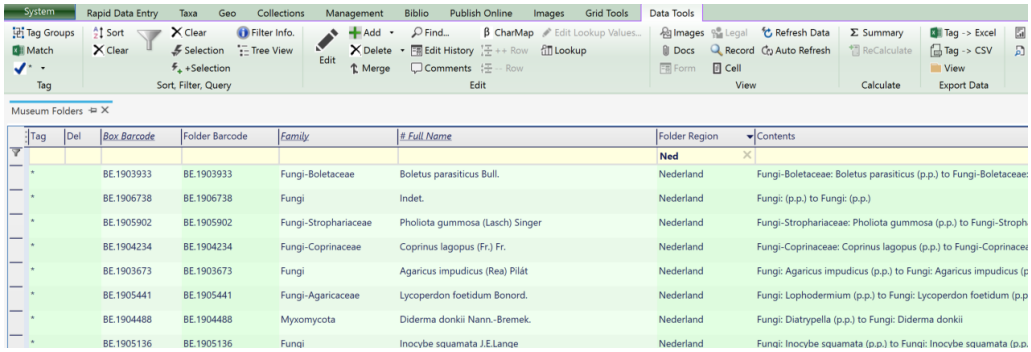
Some museums (including herbaria) organize material in boxes which may have barcodes and location details.



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.





Example list of folders. Folders have a species name content and often have a geographic region. Screen taken from Naturalis herbarium database.

Determinations (Annotations)

Introduction

The identification of a specimen may change. When a new determination is provided, a determination record is added for the specimen. Adding a new determination is usually better than simply editing the existing determination record as it ensures that previous determination details are maintained. However, where there is a simple mistake, editing a det record is normal.

A collection event may have one or more specimens. Each specimen may accumulate different determinations over time. A decision must be taken as to which name to select as the correct one.

How taxa names are stored for collection events, specimens and determinations.

The Collection Event (CE) record is where the current determination of the collection is seen. If, for example, you want to map the distribution or list all the collections of a given species, you can filter on that species in the CE table.

You can see this name in the individual taxa name fields (family, genus, species, *etc.*) as well as in the calculated taxa names: # Full Name and the HTML version of that. Note that there are various other taxa names visible in the collection event record including the Natural Sort name and the Accepted name (with its HTML version) some of which may only be updated on a recalculation of names in the species table.

The CE record itself does not store these species names. The names are coming from the main species table via a link between the CE and species tables. Thus, if you edit the spelling of any part of a name in the family, genus or species tables, those changes will automatically appear in the collection event – and in any other table that links to species in this way.

Editing determinations

Editing a collection event determination directly

In some cases, normally restricted to collection events (CE) that have no specimens (*i.e.* field observations), you may choose to edit a CE determination directly using a lookup in the taxon field. This will change the name of the CE record but will not add a determination record.

Editing specimen determinations from the Collection Event form

The Collection Event (CE) form includes options to add, delete and edit determination records.

Choose the CE record to edit, open the form in Edit mode and select the form's Specimens tab. If there is more than 1 specimen, select the one you are working with.

In the lower part of the screen, select New to add a new name, completing the details that you have (date, det.by name, notes). NB. After adding the name, set it as the Current Det of the specimen as appropriate (tick the Current Det option). There is also a Current Det. tick box on the Det editor itself - you can also set the current det status here when adding the new det.

If you wish to choose this new name as the CE name, select the option 'Set as Selected Collection Event Det.' NB. this option is only enabled when the name added is selected as the Current Det for this specimen. If you do set this option, the CE name is updated and also, the specimen table field Determination is updated.

Also to note, the specimen which is used to set the current det. of the parent CE is displayed in bold font. If more than one specimen is in bold it could cause errors if the current dets of the bold specimens are not identical. This can be rectified by using the Set as Selected Collection Event Det button which will leave just the specimen for the selected current det in bold.

Editing specimen determinations from the Specimen form

Choose the specimen record to edit, open the form in Edit mode and select the form's Det. History tab. If you want to choose this name as the current (accepted) det for this specimen, make sure the Current Det option is selected. If you also wish to use this name for the Collection Event, select 'Set as Selected Collection Event Det.'.

Adding batches of determinations via RDE

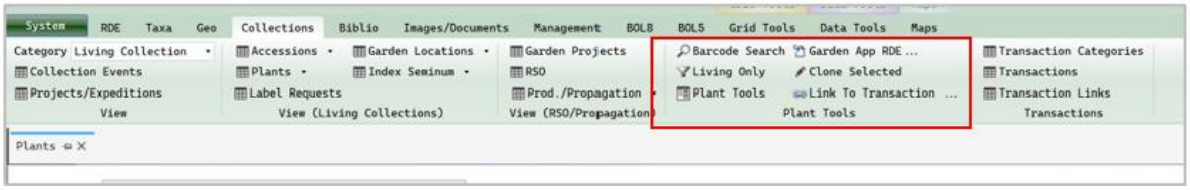
You can add new determinations in batches using RDE. Create a new RDE file of category Specimen Dets.

This RDE must include the herbarium/institution code and either a specimen Barcode or an Accession number. You can add the species name, det. by name and date with other determination details.

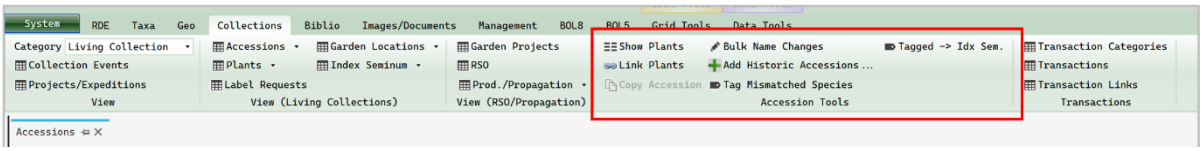
In order to update the specimen current det to the RDE names, add "*" to the field Current Specimen Det. In order to set the new name as the Collection Event det. You MUST also tick the field 'Set as Collection Det.?' Slight confusion here as logically, the field Current Specimen Det. Should also be a tick box rather than requiring an "*". This will be adjusted in future revision.

BRAHMS for Botanic Gardens

Introduction



The Collections menu andPlant Tools as shown with the Plants table opened.



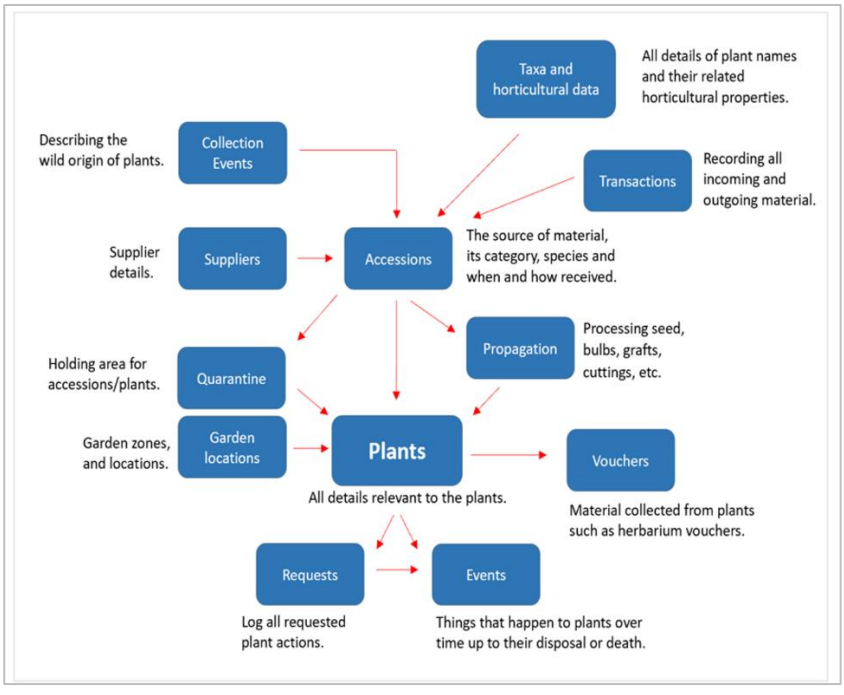
The Collections menu and toolbar as shown with the Accession table opened – showing the different tools options to those available with the Plants table.

The BRAHMS living collections module manages data and related media 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 features to manage garden accessions and plants. With everything in one place, it becomes possible to develop a comprehensive system for management and research.

Taxa	An infrastructure of taxa from higher classification to infra-specific levels, cultivars and hybrids. Storing synonymy, common names, trade names, groups, series, grexes, patent IDs, descriptions, native distribution, hardiness, shade tolerance, water requirements, conservation status and further horticultural details as required.
Gardens	Garden name(s) and details, especially useful for multi-site projects where each garden/site may have its own configuration requirements.
Garden Layout	Garden locations are recorded from defined garden areas or theme zones down to pinpoint map locations with options to record bed, grid numbering and map shape files.
Institutions	Comprehensive lists of institutions and addresses of suppliers and donors or those receiving material through purchase or transaction exchanges.
Accessions	Storage of 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.
RSO	Requests, Scheduling and Ordering. A module that manages the flow of plant material from the curator request through scheduled ordering leading to final production and delivery. Used for display/seasonal and accessioned material.
Production	Tracking plant production with periodic measurements.
Propagation	Propagation details for all plants including cuttings, grafts and seed - linking this to production propagation to supply garden plants.
Plant records	Storing plant records, linked to accessions, with all details of plants in the garden from planting out to their disposal, loss or death.
Plant events	Events for plants. Examples are plant maintenance and stock-checks; name changes; observations on leaf flush, flowering, fruiting, disease and cause of death.

Plant requests	Requests are logged in the plant management requests file with their ongoing status.
Label requests	A table showing label requests, pending or otherwise, used to control label print runs.
Transactions	The management of incoming material, exchanges and other transaction categories as defined.
Collection Events	Details about what was collected when, where and by who. Collection events are used to record the wild origin of plants and other collected material such as herbarium specimens. An herbarium specimen or other material with garden origin will have an event linked to a garden plant.
Vouchers	Vouchers and related materials can be stored for wild collections and/or established garden plants.
Images and Documents	Images and documents associated with Accessions, Plants, Vouchers, Transactions, *etc.* These can be physical files or media library URLs.
Legal/Permits	Details of all permits and related documentation for the accession, use and exchange of material, evidence of due diligence and restriction requirements.

Summary of the key components used in the living collections module.



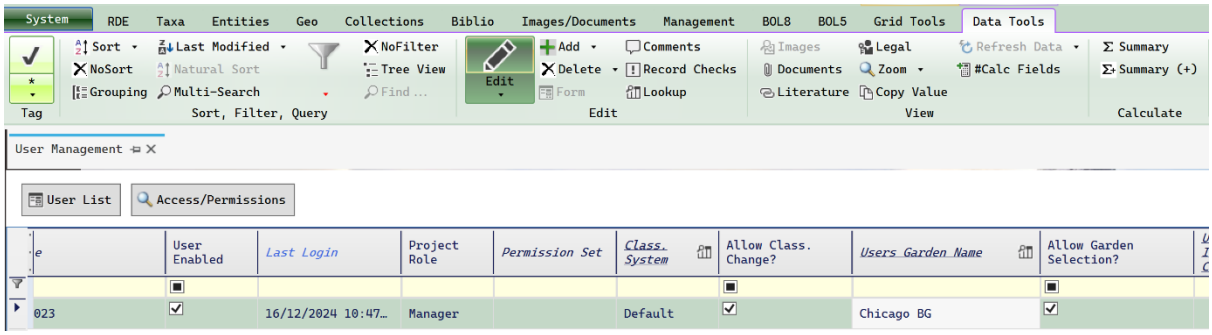
The key tables and relationships associated with the Living Collections module.

Getting started with the living collections module

There are a number of procedures to consider when starting a new project:

Assigning a default garden for users

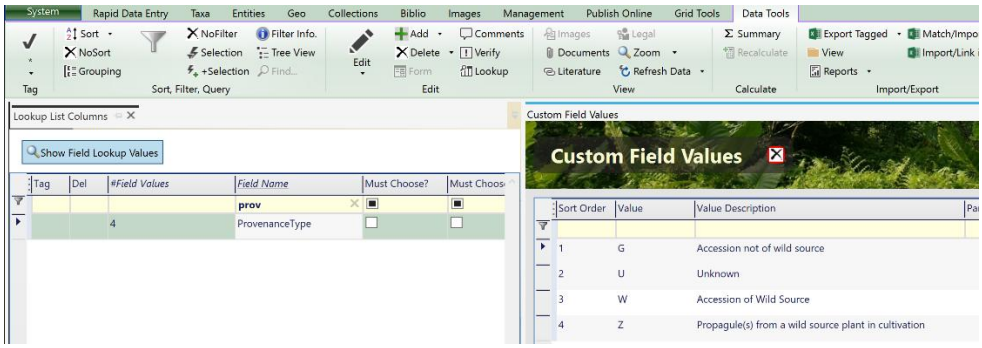
Select **System > Manage Users and Permissions** and, in Edit mode, select the User Garden Name using a standard lookup procedure. In multi-garden projects, you can optionally allow a user to switch to another garden.



Adding the default user's garden name is important as it influences various functions in the system. Note that you can optionally allow a user to switch gardens where more than one is registered.

Import default living collection lookup lists

The Plant and Accession tables have many fields suitable for use with custom lookups. You can use these to speed up and standardise data entry and editing tasks. You can import lookup lists from xlsx. These will be added to your custom lookup dictionary. By defining custom lookups, you can force users to select from pre-defined lists rather than type in free text. Examples would be with plant living status codes (Alive, Dead, etc.); reason for loss (disease, drought, etc.); Provenance type (W, G, Z, U); and Supplied as (seed, cutting, plant). Details on managing lookup lists are provided in the section on Lookup lists.



Most gardens share a common set of lookup values for many standard fields, for example U W G or Z for Provenance Type.

Accession and Plant ID numbering

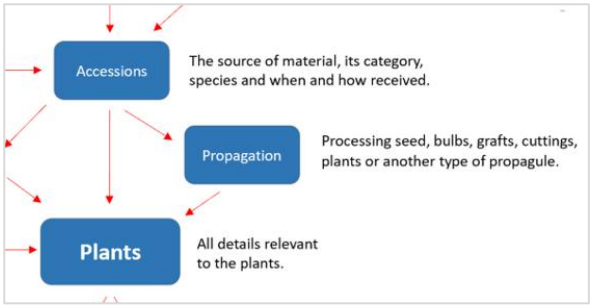
While you can opt to have 'no rules' numbering, most gardens will adopt an automated numbering system for new accessions and plants. The setup options for these are discussed in the relevant sections below.

Keeping your species data in good shape

Information about taxonomic names from higher levels down to infra-specific ranks is provided in the main taxa section of this guide. 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. 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.

Accession records

Accessions vs Plants





Left. An Accession may lead to several garden plants. Right. A selection of the fields available in the main accession record.

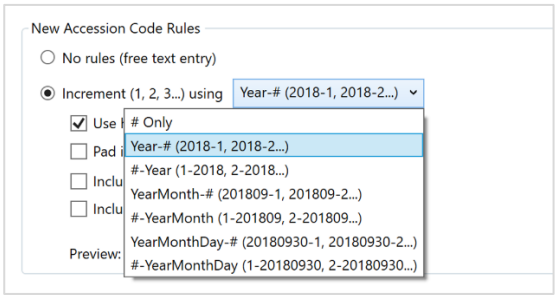
Accession records include details of the type and quantity of material received; from who and where from; the 'received as' species name; its wild origin if known; and other details about the material, as available.

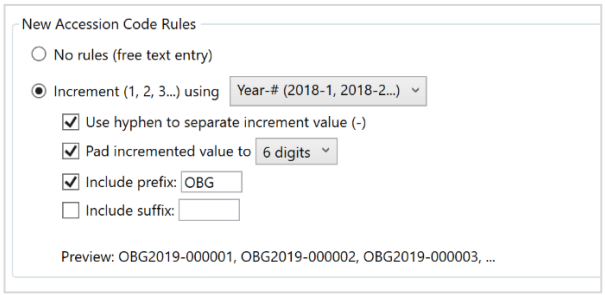
To see all the fields available, the best procedure is to select **Collections > Accessions**, assuming the Category '*Living collections*' has been selected, then select **Grid Tools > Manage Columns**. Here you can scroll down the entire field list. An accession record is always one species. Once processed and propagated as needed, perhaps over several years, an accession will then potentially lead to one or more garden plants.

Accession numbering

Accession numbering systems vary from project to project. A common approach is to use a sequential number combined with the accession year, for example 2015-01, 2015-02, ….

Accession number formatting is controlled from the settings on **System > Options > Living Collections > Accessions**. Here, you can opt for free text entry (no rules) or choose from a set of rules to define numbering. These rules apply when new accession IDs are added to the system.

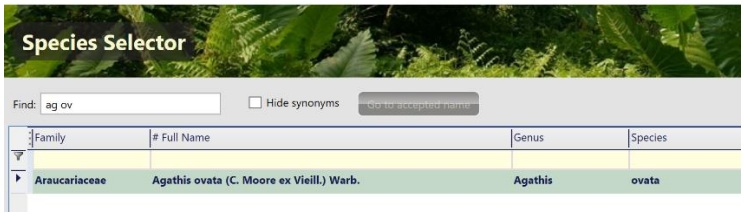




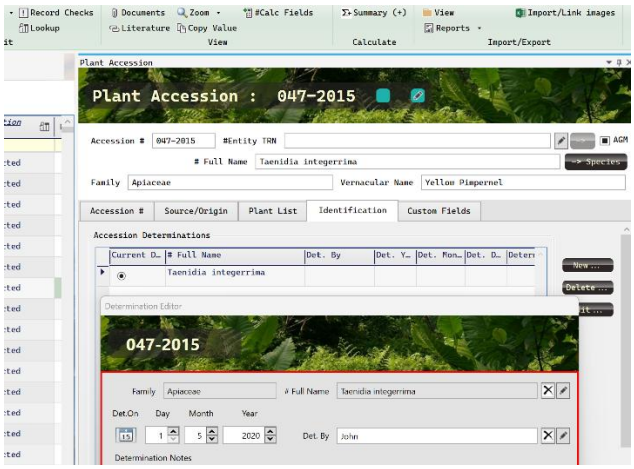
Left. Choosing the overall format for incrementing accession numbers. Right. Some further settings such as padding and adding a prefix. The preview shows how your numbers will appear.

Adding new Accession records

When adding batches of new Accessions, the most efficient way is to use Rapid Data Entry (RDE). This is discussed in the RDE section of this guide. To add a new Accession record manually, open the main Accessions table on the **Collections menu** and use the **Add** option. You can optionally do this with the form opened. The Accession ID will be auto-calculated depending on your configuration settings. The number of fields you add is optional but minimally, you should add the species name. For this it is best to use the lookup for the *Received As Species* name as this will also set the *Current Species Name* which can be edited if different.



Locating a species is efficient, even when you have many 1000s of names. Refer to the section on locating species names for some hints.



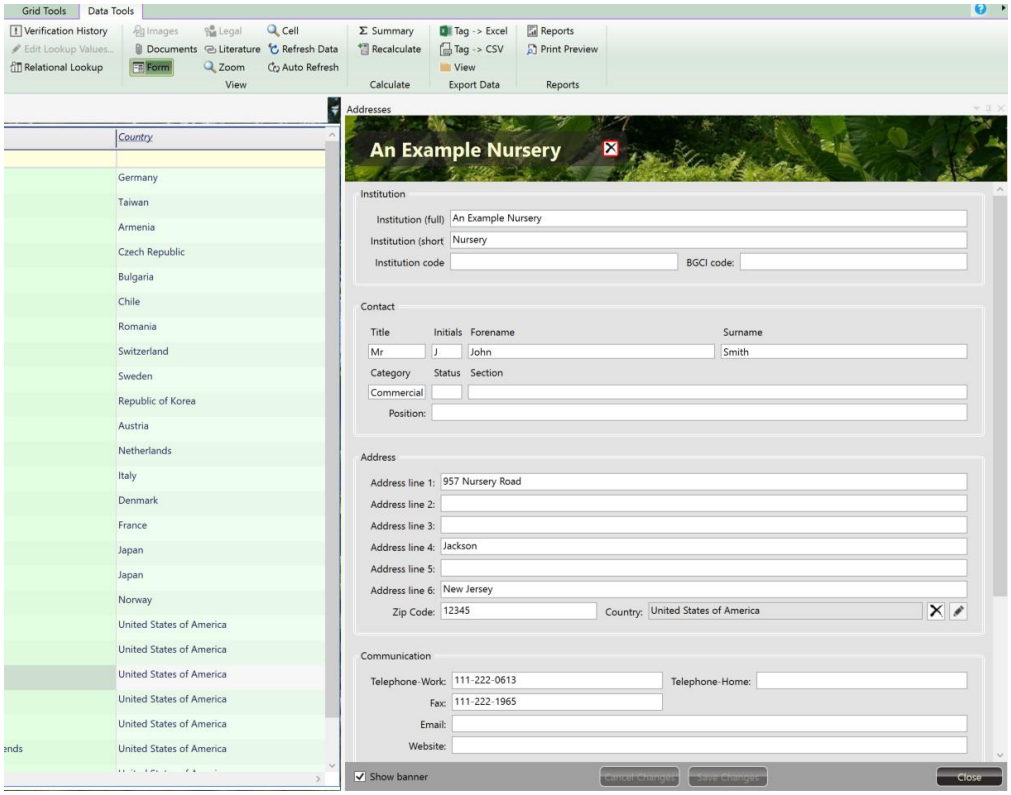
If you want to record determination edits more formally, use the Identification tab on the Accession form. Here, you can record multiple names for an Accession, with details of who provided the name changes.

Source/Wild origin

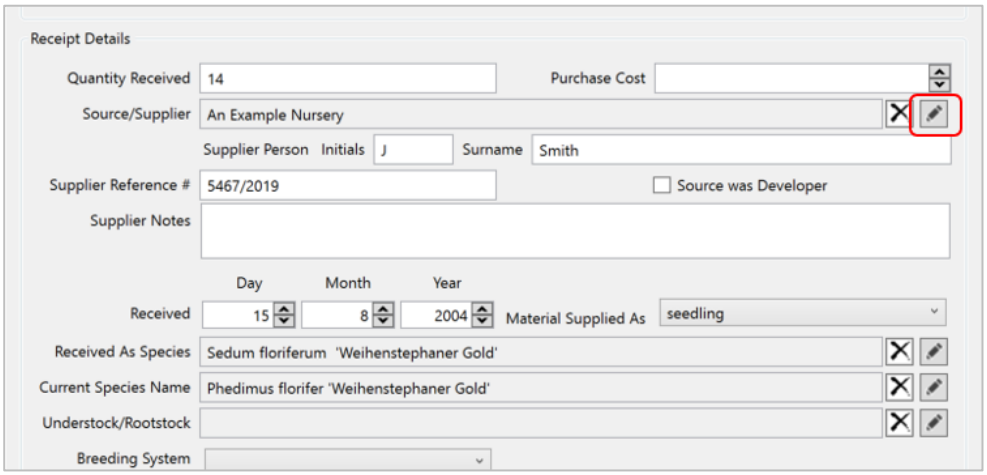
The source/wild origin of an accession can be registered from the **Source/Origin** Tab on the accession form. This links the accession to a an existing or a new collection event. The accession record also has text fields to describe the origin.

Supplier/donor 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.



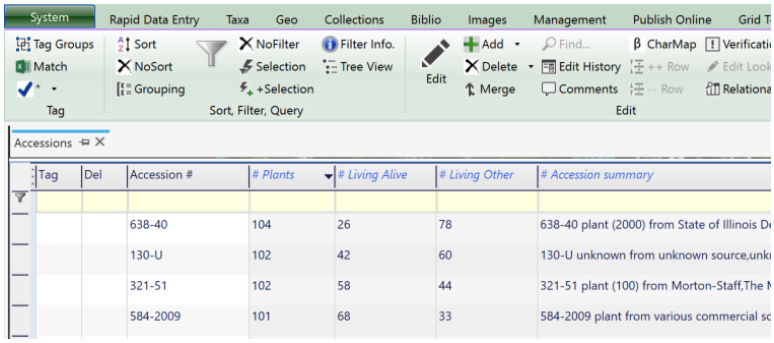
An example entry in the Address Book



A section of the Accession table form showing the lookup option for supplier names.

Calculated fields for accessions

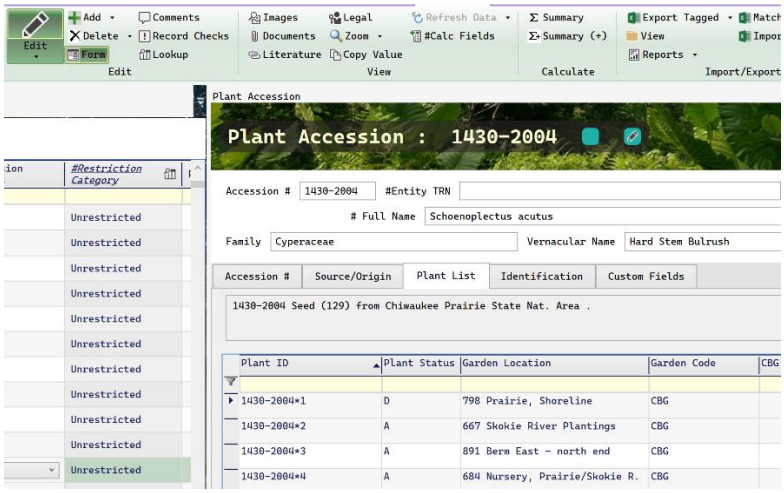
As with many other tables, the Accession table has some handy calculated fields which can be updated from **Management >Recalculations**. Bear in mind, recalculations can be run as an automated overnight process. Calc fields can be selectively enabled using Manage Columns or you can view them all using **#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 List per Accession

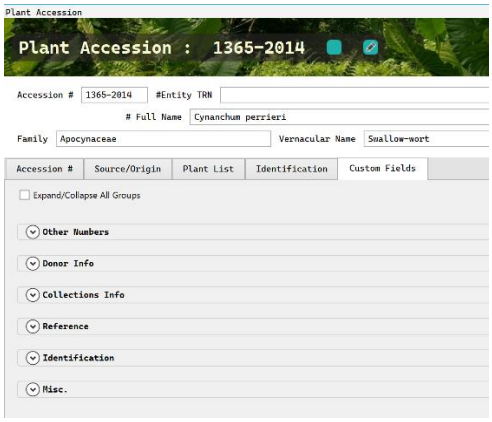
A quick way to view all plant records for a given accession is to use the **Plant List** tab on the Accession form. This a provides a summary of the accession origin and a grid list of the plant records.



The visible fields can be adjusted by right- clicking on the grid header.

Accession Custom fields

You can define custom fields for the Accession table and organise these into groups.



Custom fields can be organised into groups. Refer to the manual section on Custm Fields.

Gardens, Garden locations and plant locations

Introduction

The garden location setup allows for single and multi-site gardens.

Garden plants can be linked to a garden location record. These location records are in turn linked to garden records thus creating a hierarchy. Gardens and garden locations can have map references and map shapes files, the name of the responsible curator and other details as appropriate.

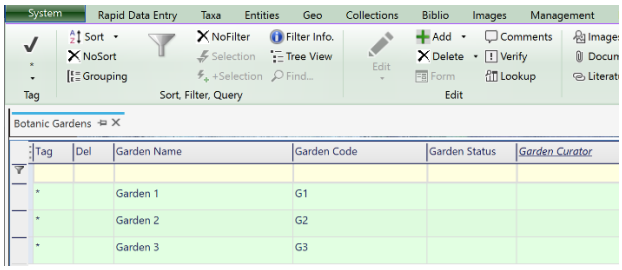


The way the garden location tables and fields are used varies by project. Different gardens have their own way of classifying the locations, their purpose and sub-divisions.

Gardens

The gardens table is opened using the **Garden Locations > Gardens/Sites** option on the main **Collections** menu when in living collections mode. Many projects will have one entry here. But if you are managing data for multiple gardens, you will need an entry for each one.

As discussed below, you can associate a user with an entry in this table, restricting their access to data from other gardens.



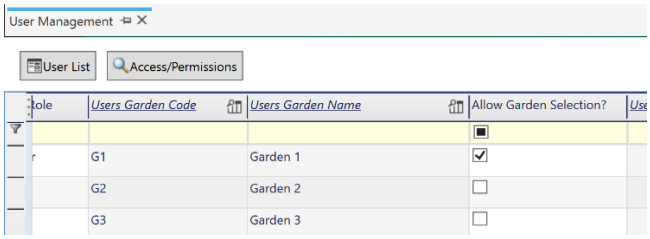
The Garden table is essentially a list of gardens used by your project. A single garden site will have one entry here.

Field Name	Notes
Tag	Standard tagging field
Del	Standard deletion field
#Images	Calculated field: number of linked images
Garden Name	Name of the garden site
Garden Code	Code if one is provided
Garden Status	Status code
Curator	Name of garden curator
Trials garden?	Indicate whether the garden entry is being used for trials.
Comments	Comments
Audit fields	Standard audit fields

Restricting access by garden

In multi-site projects, they may be a requirement to restricted access and editing rights on a user-by-user basis. For this purpose, the main User table has options to manage these restrictions if required.

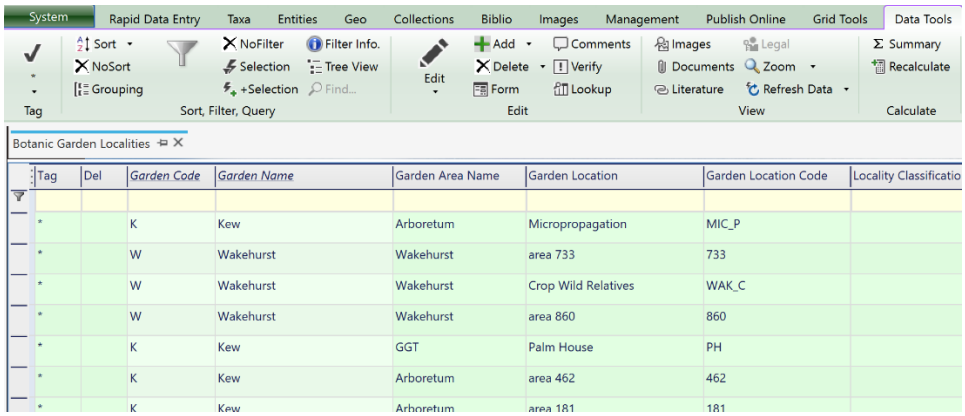
Under **System > Manage Users and Permissions** use a lookup option to associate a user with a selected garden name/code. If you select *Allow Garden Section*, that user would be able to override the selected garden name. Otherwise, the user will be restricted to see and edit data from their assigned garden.

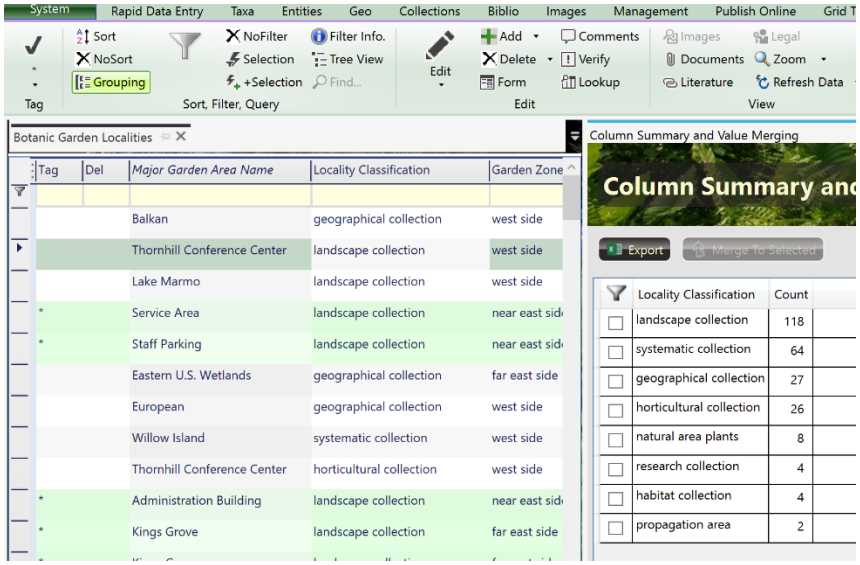


The user table assigning default garden entry and permission to swap to a different garden site.

Garden localities

The garden localities table is opened using the **Garden Locations** option on the main **Collections** menu (when in living collections mode). These records can be linked to the garden entries as discussed above using a lookup in the Garden Name field. Localities can be classified into functional areas, categorised into zones and assigned a garden locality code. Further fields are defined below.

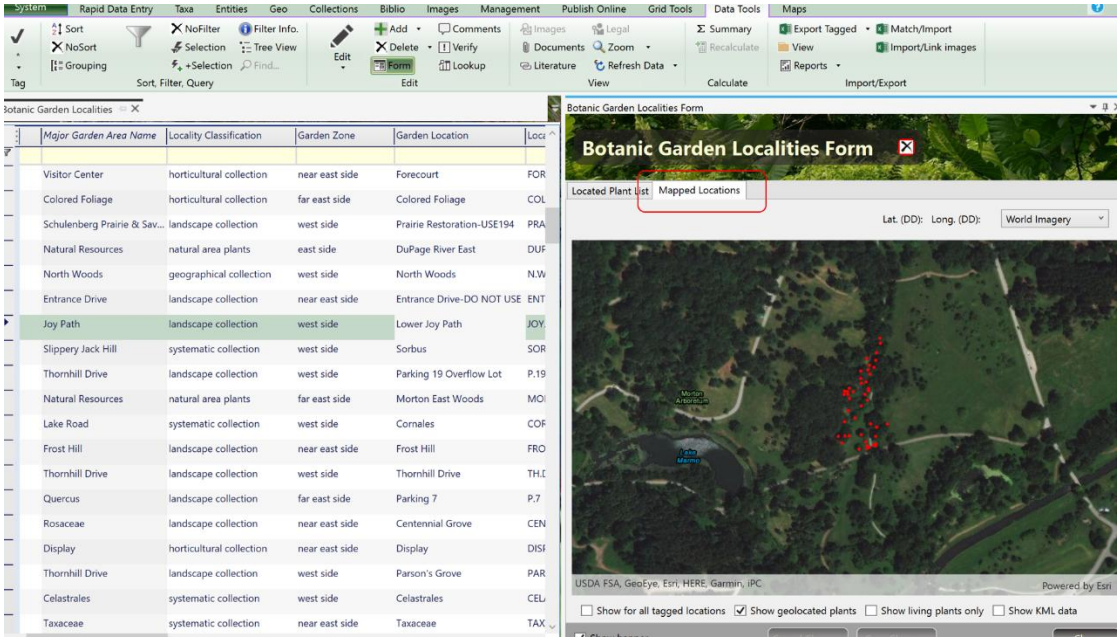




Locations can also be assigned a Locality Classification which can be used to indicate the overall purpose of the location. The examples above are provided by The Morton Arboretum.



Using locality table form, you can list plants per location. A Right Click on the form grid header allows you to choose the visible fields. Moving through the main grid updates the plant list.



Using locality table form, you can map plants per location. Moving through the main grid updates the map. Various options are provided to filter plants on the form. The garden locations form can also draw shapes (garden areas) based on the file name added to field KML File.

Field Name	Notes
Tag	Standard tagging field
Del	Standard deletion field
#Living Alive	Calculated field: number of linked plants with status Alive (or equivalent)
#Living Other	Calculated field: number of linked plants with status other than Alive
#Families	Calculated field: number of families in location (from plant record links)
#Genera	Calculated field: number of genera in location (from plant record links)
#Taxa	Calculated field: number of taxa in location (from plant record links)
#Wild Derived	Calculated field: number of plants with Provenance Type = W
#Cultivated derived	Calculated field: number of plants with Provenance Type = Z
#Images	Calculated field: number of linked images
Garden Name	Name of the parent garden (from Garden table)
Trials Garden?	Indicate if used for plant trials
Garden Code	Garden code – optional (from Garden table)
Locality Classification	For example, Landscape collection, Horticultural collection, …
Garden Area Name	Name of a garden sub-division
Garden Location Name	Name of the garden location
Garden Location Code	Location code if one is provided
Location Status	Status code
Location Renamed to	New name for a location (set using a lookup)

Location Code Renamed to	New code for a location (set using a lookup)
Aspect	Location aspect
Grid	Location grid reference
Latitude/Longitude	Map reference fields also with datum, resolution, origin…
Elevation	Min and Max altitude
KML file	Shape file
Prefix	Text prefix for area name (can be used in e.g. reports)
Curator	Name of area curator
Comments	Comments
Audit fields	Standard audit fields

Plant table location fields

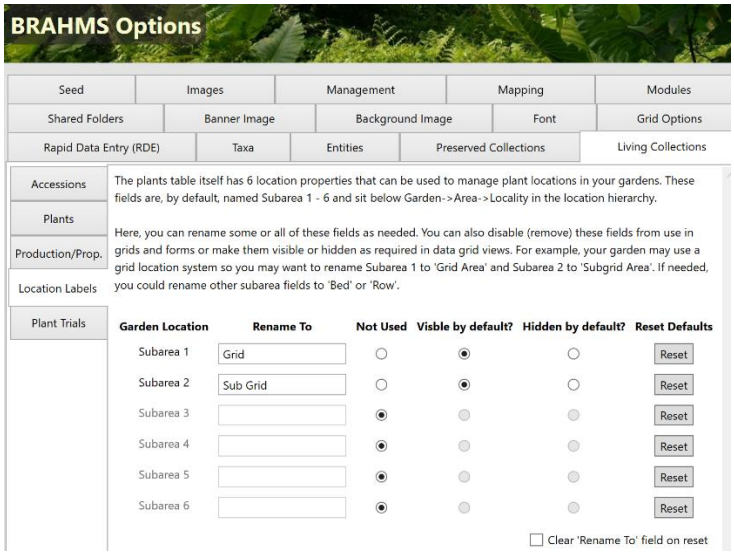
In addition to the above location details stored in the garden locations table, more precise plant location details are added to the plant table itself. Bear in mind that the plants table is related up to the locations table.

Different gardens have their own system for recording plant locations. BRAHMS provides options for storing up to 6 sub-area fields – these being defined using a system configuration option.

Field Name	**Notes**
Garden Name	From Gardens table
Location Name	From parent garden locations table
Subarea 1	As configured (see below)
Subarea 2	As configured (see below)
Subarea 3	As configured (see below)
Subarea 4	As configured (see below)
Subarea 5	As configured (see below)
Subarea 6	As configured (see below)
Sequence	Sequence (e.g. for inventory or trail)
Latitude /Longitude	Map reference
Elevation	Min/Max altitude
Garden Location Notes	Free text

Garden location subareas

The plant table itself has 6 plant location properties that can be used to manage plant locations in your gardens. These fields are, by default, named Subarea 1 - 6. You can rename these fields to suit your own purposes. You can also disable (remove) these fields from use in grids and forms or make them visible or hidden as required in data grid views. For example, your garden may use a grid location system so you may want to rename Subarea 1 to 'Grid' and Subarea 2 to 'Sub-grid'. You might then disable the other Subarea fields.



Configuring the plants table sub-locality fields. In this example, only 2 of the 6 possible fields are being used.

Plant records

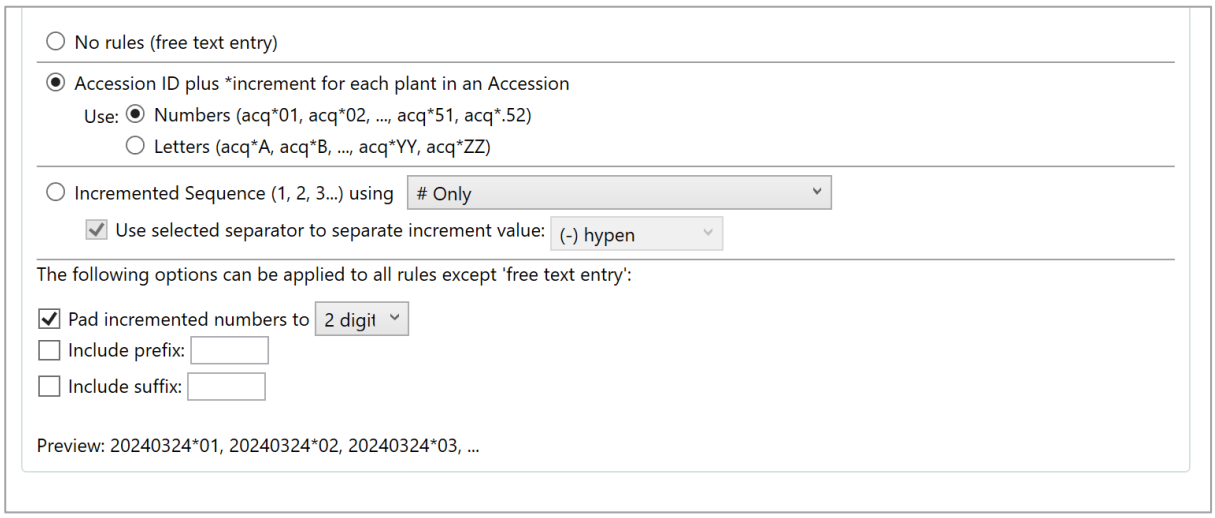
Introduction

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 the species/identification.

Plant numbering

Plant numbering is treated in a similar way to accession numbering although there are several different options. For example, you can use the Accession ID as the basis for the Plant ID or you can use various types of incrementing numbers such as **Plant year + Incrementing sequence** for that year. Plants can use numbers or letters when in sequences.



*Plant number is configured using the options on **System > Options > Living Collections***

Editing the plant table

Adding new plant records

When adding batches of new plant records, the most efficient way is to use Rapid Data Entry (RDE). This is discussed in the RDE section of this guide. Bear in mind, RDE can be used to add accessions only or accessions and plant records. Also note that each RDE accession record may have more than 1 plant.

When adding new plant records directly to BRAHMS (rather than via RDE), you open the main plants table and use the **Add** option. It is important that you have checked and edited the setup options under **System > Options > Living Collections**. The options here control how new plant IDs are calculated.

When adding a new plant, the first step is to choose or add a plant accession record – using the lookup provided at the top of the Add Plant form.

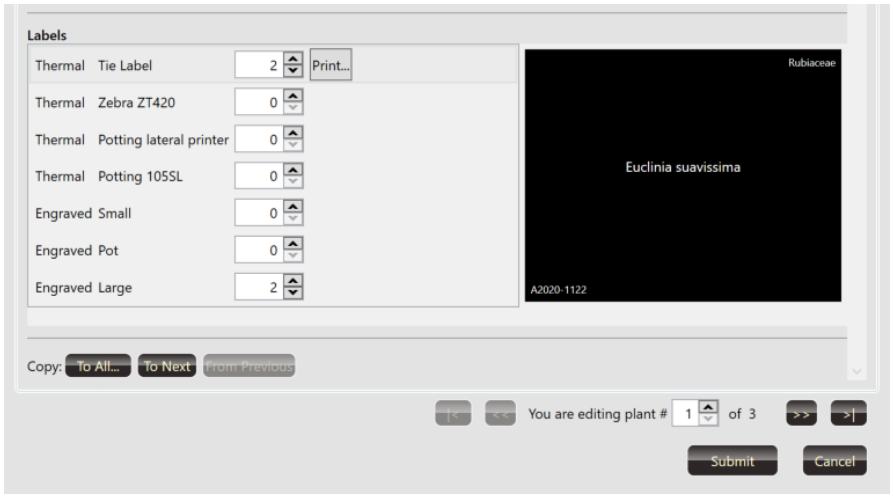


If adding a new accession, you will be directed to another form that allows you to enter all aspects of that accession including species, supplier, wild origin, order dates, *etc.*

You can add data for 1 or more plants at the same time by editing the '# Plants to add'. Field.



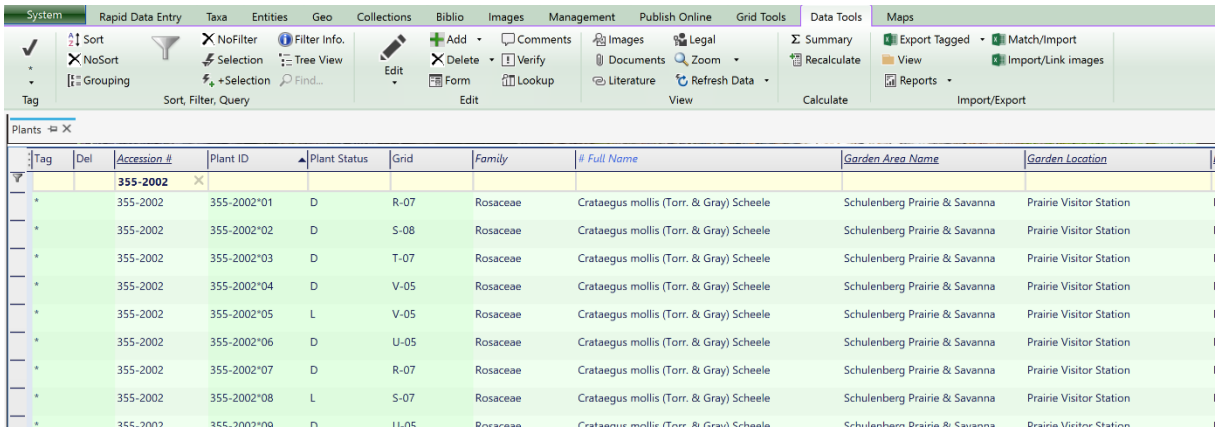
The upper part of the add plant form allows you to enter the plant garden location for each plant you are adding. Note that the Subarea fields are configured from **System > Options > Living Collections**. In this example, 3 of the 6 maximum subarea fields are in use.



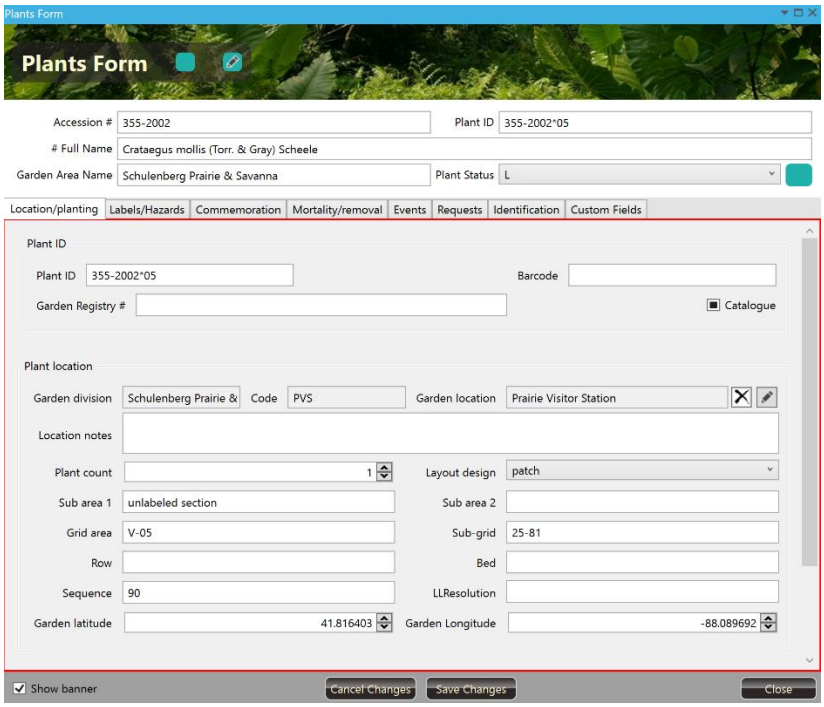
The lower part of the form provides the means to print and/or request labels. The labels listed here are as entered in your main Labels table.

Editing plant records

Opened from **Collections > Plants -** assuming the Category Living collections has been selected. In **Edit mode**, all non-lookup fields can be edited directly in the grid or on the form.



A plant grid with a filter set on a single Accession. This Accession has several plants in different grid areas.



The Plant table form opened. As there have been unsaved edits, the form has a red surround and the Save Changes option is enabled. This form has several tabs with different functions.

Plant status

Introduction

The plant status field is a key data field in the plants table as it informs whether a plant is alive/active or dead/inactive (or using your own terminology). A dead plant may be resurrected.

Plant status has 3 possible levels of information:

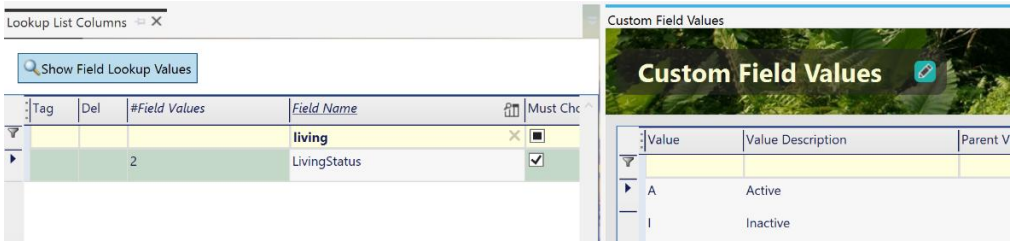
- The Status itself stored in Plant Status field.
- A Reason for change.
- Change reason notes.

The status is defined as a simple lookup and will have values such as Alive or Dead.

The reason and reason notes can be free text but either or both can be defined as event lookups (see below)

Registering living status values in your lookup list

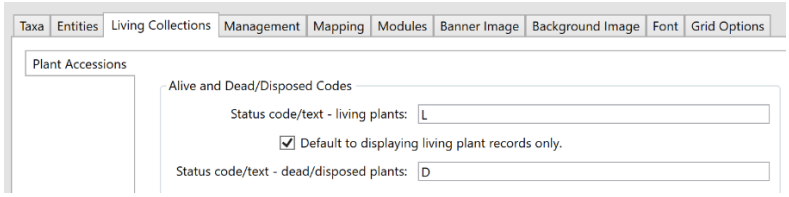
You should register the values you want to use to the LivingStatus field in your Lookup dictionary. There is no limit to the number of values added, the simplest approach being to add one value to represent living and another for dead. However, you may wish to refine the codes for non-living, for example lost, disposed, etc. You can use codes or words up to 15 characters in length.



An example lookup with two entries. To understand how to edit the values, refer to the section on editing your lookup lists.

Configuration option for Alive status

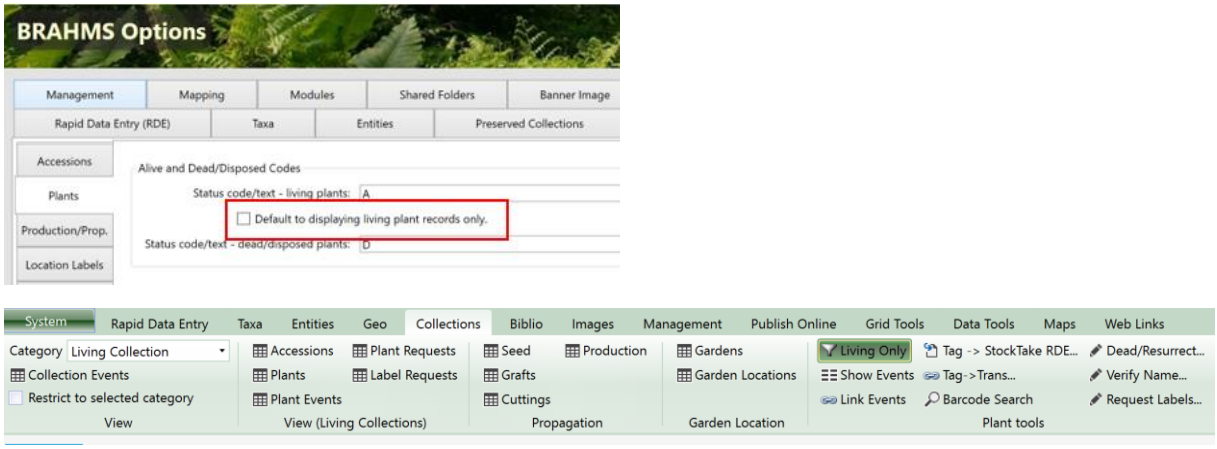
As certain calculations refer to the plant status code, BRAHMS has to know which code you use to represent a living plant in the plant record *Living Status* field, for example 'L', 'A' or 'Alive'. To edit this code or text, select **System > Options > Living Collections**.



Setting status codes for accessions and plants. The code for living plants is used by BRAHMS with a number of calculations and settings. The code for dead/disposed is less important in this setup bearing in mind that you may have several codes representing dead, disposed, not found, etc.

Hiding dead plants by default

The setup option *Default to displaying living plant records only* is used to hide non-living plants by default when the plant table is opened. This setting can be over-ridden when in the plants table itself.



When working on the main Plants table, you can override the default setting to view living plant only (if this has been selected).

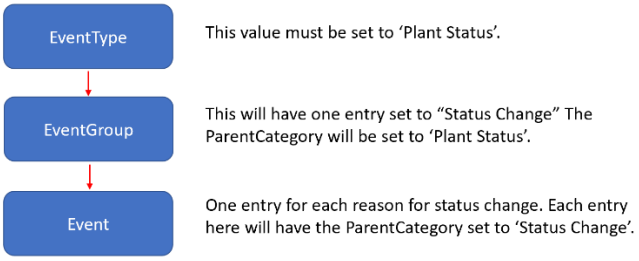
The current way we add Living Status lookups and change reasons is quite complex. In re-writing the manual section on this, it's become ever clearer that it could do with standardization.

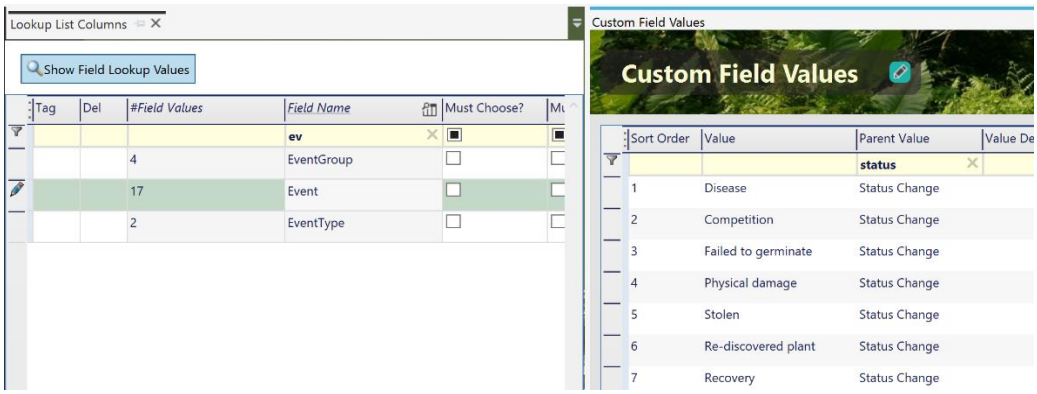
The Living Status itself is a standard lookup e.g. Alive Dead: LivingStatus. The (new) Status Change Notes field is also a standard lookup: LivingStatusChangeNotes. The Reasons for Change however are stored as 3 level hierarchy event entries. Plant Status -> Status Change -> Reason. As a consequence, you can't easily discover it in the look up list and it's quite hard to explain this.

The solution may be to make the Reasons for Change dropdown a standard lookup although it would still be added as an event. There may be a reason why we did it this way, but at present, I can't fathom it out.

Registering reasons for changing plant status

Separately to the living status codes themselves, you need to register the reasons for changing plant status. When editing plant status, the system enforces you to provide a reason.





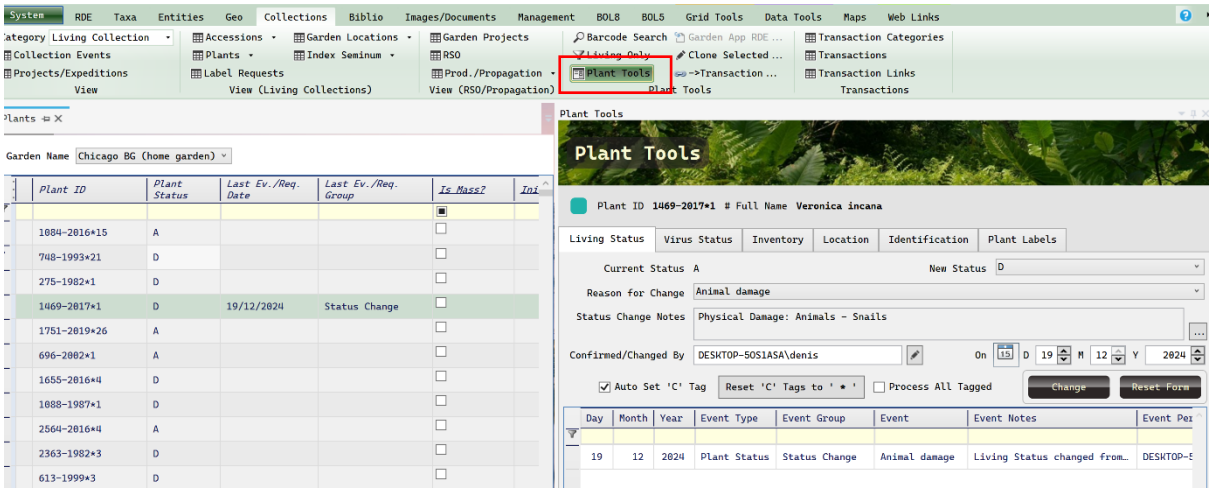
Example entries added to the lookup list.

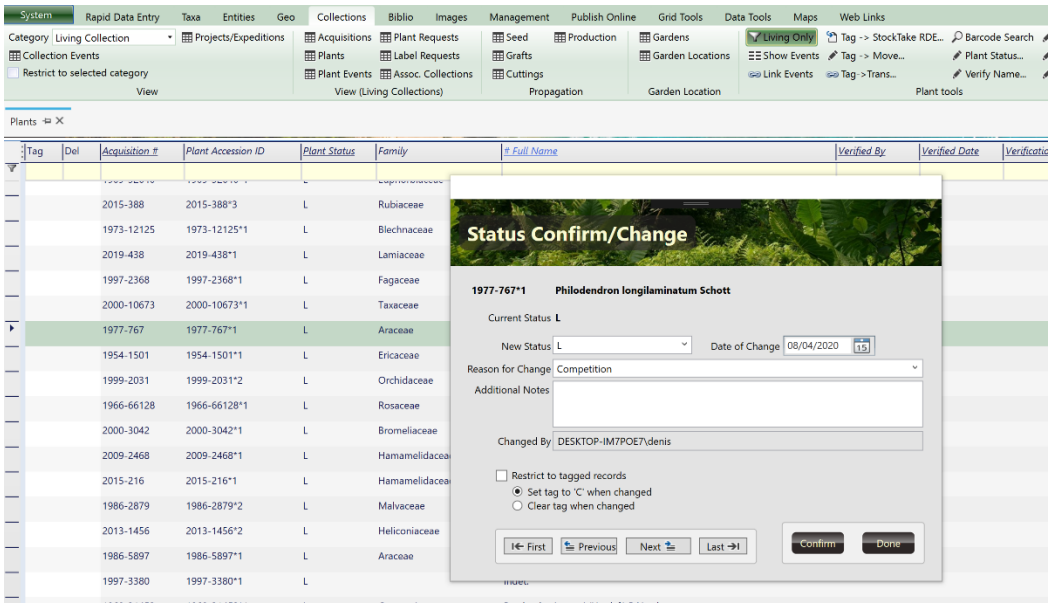
Confirming or changing plant status

The plant status field cannot be edited directly in the data grid. This is to enforce users to provide a reason for the edit. Thus, a small form is used to add the change reason and optionally, add some additional notes. It is also useful to record who made the edit and when. All changes to this field are logged as plant events, thus keeping a record of all status changes made to a given plant. To edit the status, you can:

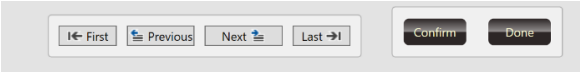
- use a lookup in the data grid Plant Status field.
- use the option provided on the Plant Form.
- use the Plant Tools option on the main Collections menu.

Each of these options leads to the same tool to edit plant status. However, when accessing the tool from the plant form, you can only edit the current plant record. Accessing the tool using either of the other options allows you to edit the current or all tagged records.

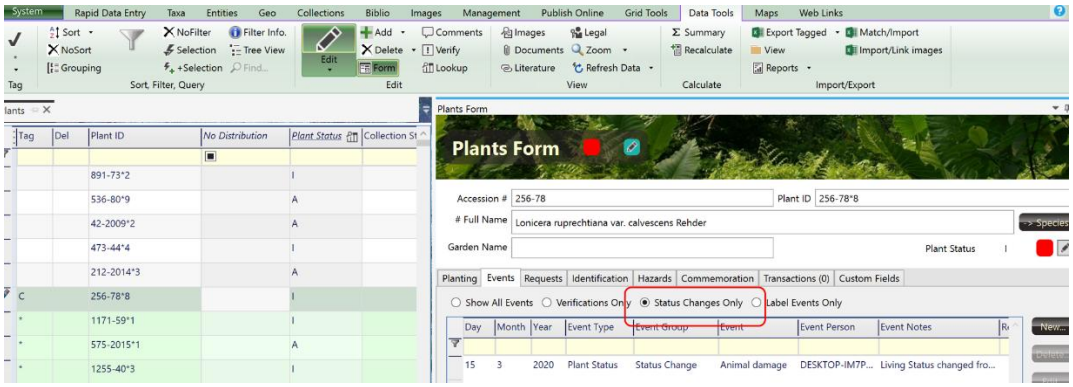




In this database, the status codes used are L for Live/active and D for dead/inactive. You can apply a change to a single record or skip through all tagged records. When editing tagged records, you can set the status change reason for each plant.



You can also use this option to confirm plant status. If the plant status is not edited, the Change button stays as Confirm. A plant status event confirm event is added.



All plant status changes are recorded as plant events. The Events tab on the plant form can be set to show status changes only.

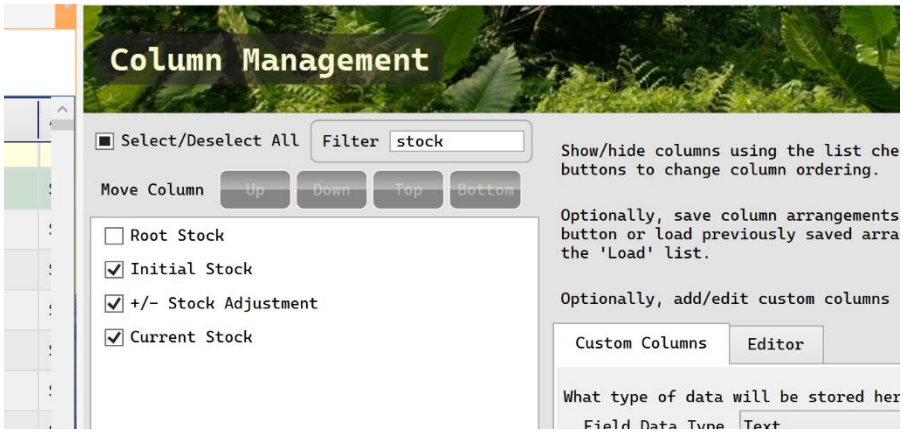
Plant stock quantities and adjustments

Plant stocks refer here to the quantity of individual plants for a given Plant ID rather that the number of plants in an accession group. A single Plant ID may refer to a group of plants which may subsequently be split up and planted out to different locations, thus receiving their own plant IDs. Some plants may also be distributed in a transaction to another garden or institution. Alternatively, plant stock levels may be adjusted for other reasons such as death or loss.

Plant stock data fields

Plant stock quantities are stored in the plant table fields:

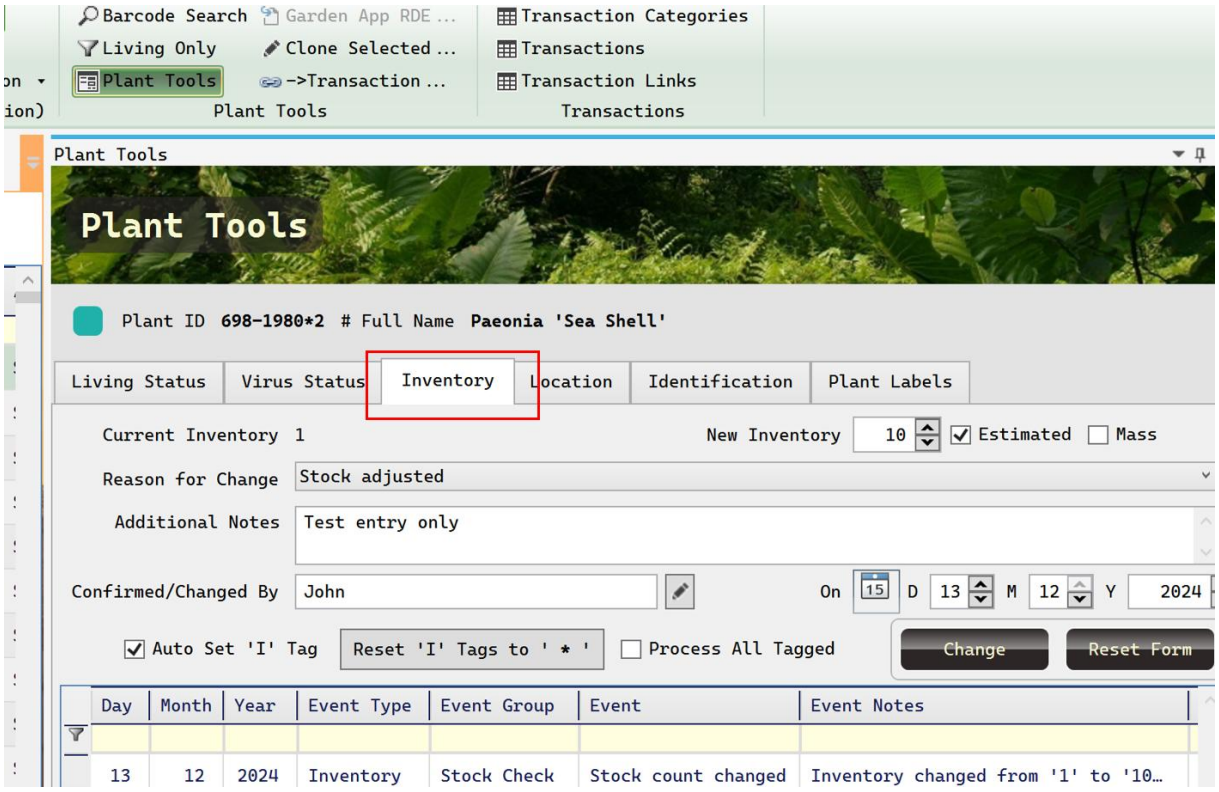
- Initial Stock: refers to the initial number of plants represented by a single plant ID record. This value does not change.
- Stock Removed is now a calculated field.
- Current Stock: the active stock quantity to edit.
- Plant Qty Estimated (yes/no)
- Mass (yes/no)



Column selection in the plants table with a filter on 'stock'. The current stock level is edited using the Plant Tools Inventory option as provided.

Adjusting stock levels

You may need to adjust stock levels following stock checking. This is done using **Plant Tools > Inventory** on the Collections Toolbar. You can also open this form using a standard lookup in any of the stock-related fields.



You can process a series of tagged records. All adjustments are added to the plant events table. The adjustment reason can be free text or selected from a list if a lookup is defined (see below).

Adding stock adjustment reason lookup values

To add a list of stock adjustment reasons and thus allow selection from a drop-down list on the adjustment form, the easiest way is to import a list of values from an Excel file. The Excel file should look like the following example:

	A	B	C	D
1	**FieldName**	**LookupValue**	**ParentCategory**	**Description value**
2	EventType	Inventory		
3	EventGroup	Stock Check	Inventory	
4	Event	Reason 1	Stock Check	Optional description of reason 1
5	Event	Reason 2	Stock Check	
6	Event	Reason 3	Stock Check	
7	Event	Reason 4	Stock Check	

Import lists of stock changes reasons via an xlsx table.

To import such a list, select Management > Lookup Fields and then select **Import from Excel** from the Management toolbar. While you can edit the actual reasons (and add ans many as you wish), you need to use EventType = 'Inventory' and EventGroup = 'Stock Check'.

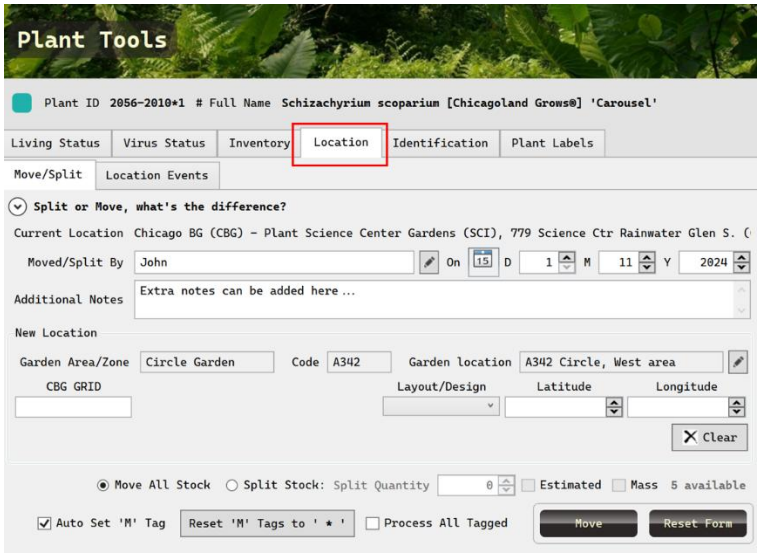
You can also add events manually to the lookup list, ensuring that the Parent Category is set to Stock Check.

Plant locations in garden

A description of plant location data is provided in the Garden Areas and Locations section.

Moving and splitting plants

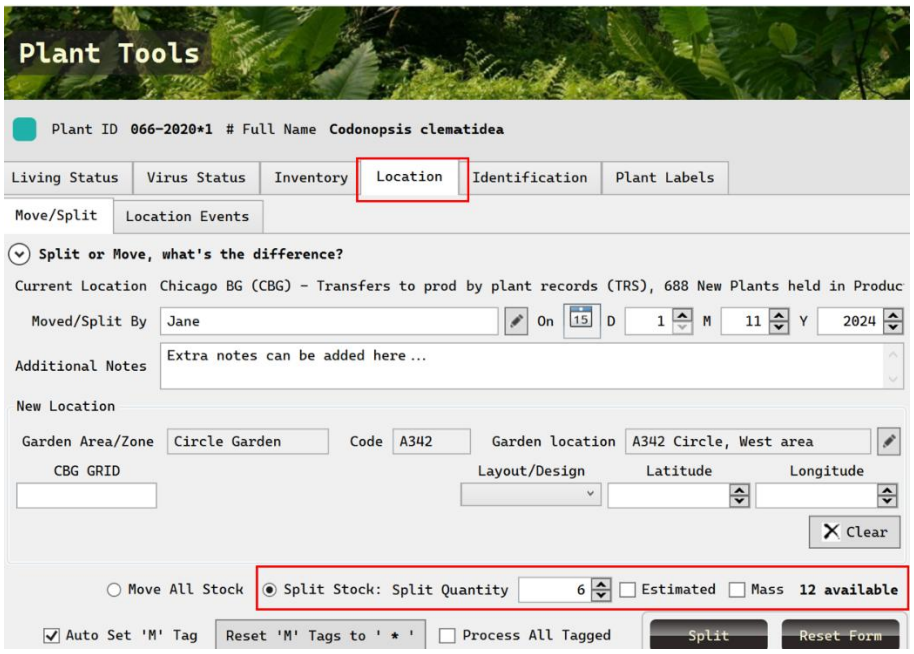
To change the location of one or more plants, choose **Plant Tools > Location** on the Collections Toolbar. You can also open this form using a standard lookup in any of the plant location fields.



Use the Location options to move or split plants.

Note that the option 'Move all Stock' is selected. To move multiple plants from one location to another, you can tag all the plants to move and then choose the 'Process all tagged' option on the location form.

If you opt to move some of the available plants, this then becomes a 'split'. When you split plants, a new plant record is created. Select 'Split Stock' and choose the number of plants to split. This number cannot exceed the current stock value.



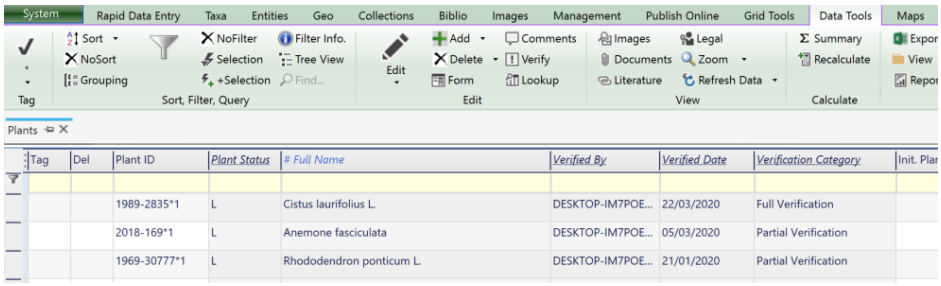
Splitting plants will create a new plant record for the current accession.

Managing plant identifications

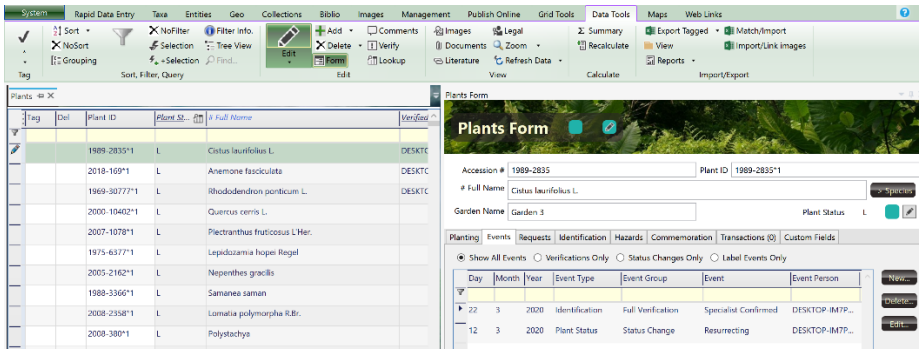
Verification of names

Name verification provides visible details about when a plant identification was verified – together with the quality of the verification. Verifications vary in their reliability, for example, they may be based on sterile material rather than fertile.

Verifications are added as plant events. The most recent verification record is also added to the plant table itself as shown below:



All verifications are added to the plant events table and can be viewed from the plant form:



Note that the Events tab has the option to restrict the event list to Verifications only.

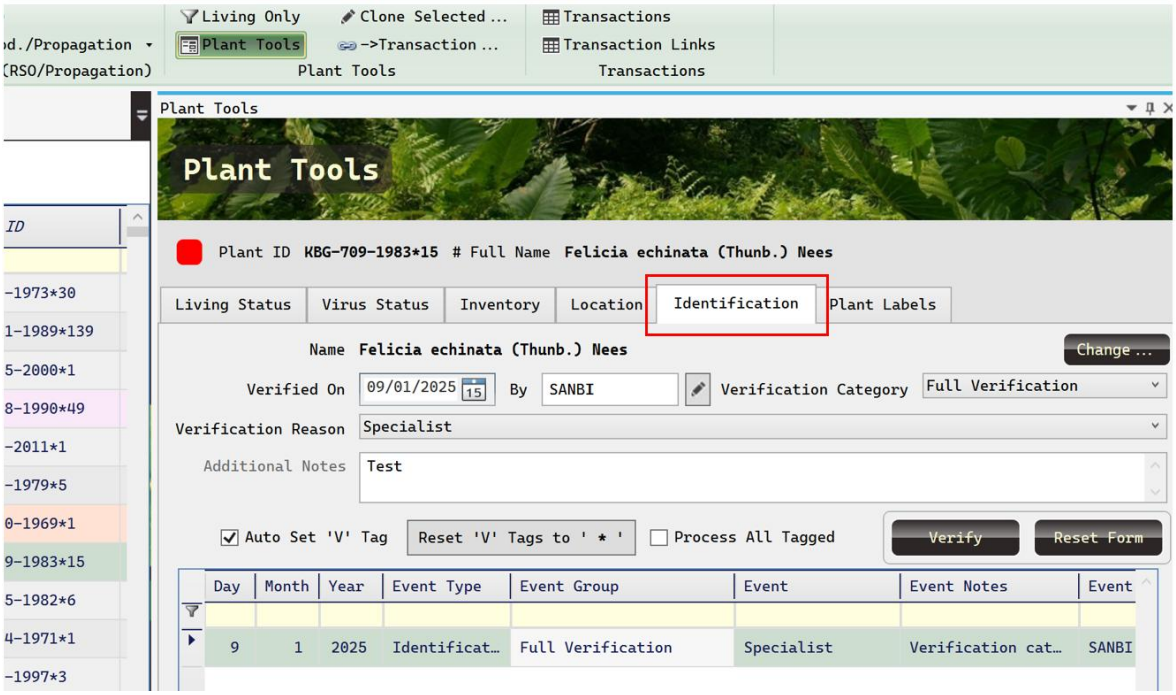
Setting up the events lookups for verifications

In order to use the verification system, you must set up the plant event lookups following the pattern below. You can change all the values except the EventType must be 'Identification'.

LookupValue	ParentCategory	FieldName	SortOrder
Identification		EventType	1
Full Verification	Identification	EventGroup	1
Partial Verification	Identification	EventGroup	2
Sterile Material	Partial Verification	Event	1
No Specialist	Partial Verification	Event	2
Poor specimen	Partial Verification	Event	3
By specialist	Full Verification	Event	1
Unambiguous species	Full Verification	Event	2

Adding/Editing verifications

To add/edit a verification, choose the Identification option on the main plant form or choose **Plant Tools > Identification o**n the Collections Toolbar.



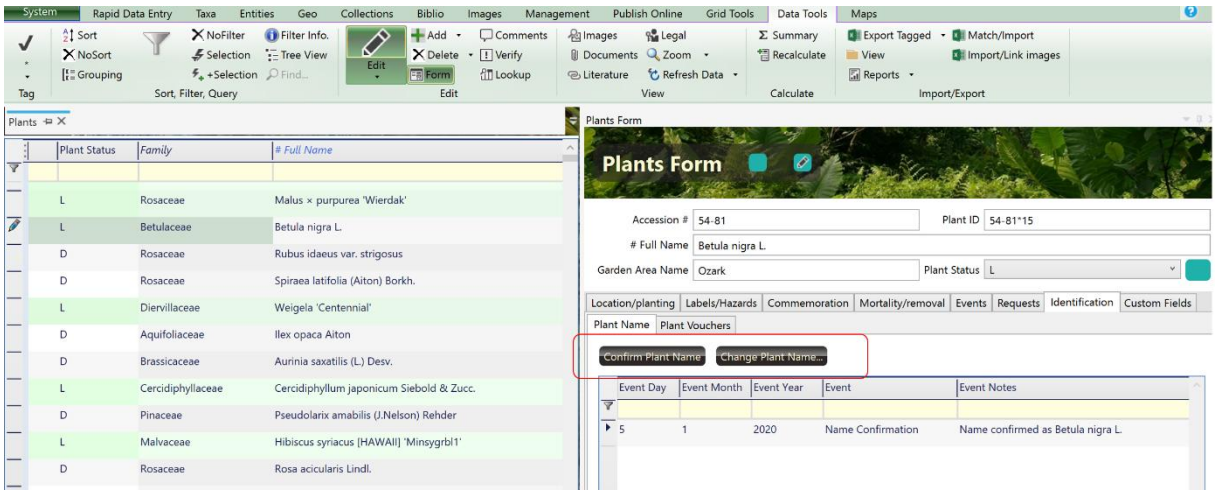
*Verifications are done using the Identification option on the main plant form or using the Plant Tools form. The form also has a **Change …** option top right providing access to the name change form.*

Changing identification

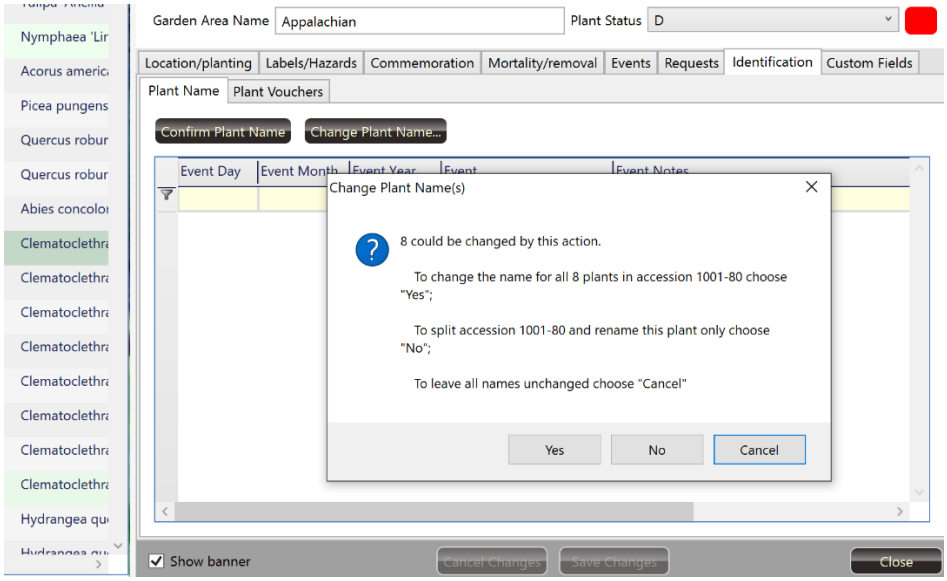
The identification (i.e. taxa name) of a garden plant is held in the parent Accession record. If an Accession has multiple plants cloned across a garden, these will have the same identification. If you edit the identification of an Accession record, this will change the name of all plants related to that Accession.

Within the plant table itself, there are further plant identification options. These allow you to:

a) Confirm a plant ID is correct (true to name).
b) Edit the name of the plant(s) belonging to the Accession. If there is more than one plant, they will all be changed.
c) Decide that a one or more plants linked to an Accession has/have the wrong name and separate it/these to a new Accession.



If a name is confirmed, a confirmation event is added to the plant Events table including the date and confirmation person. All plant events, including confirmations, are listed from the Events tab.

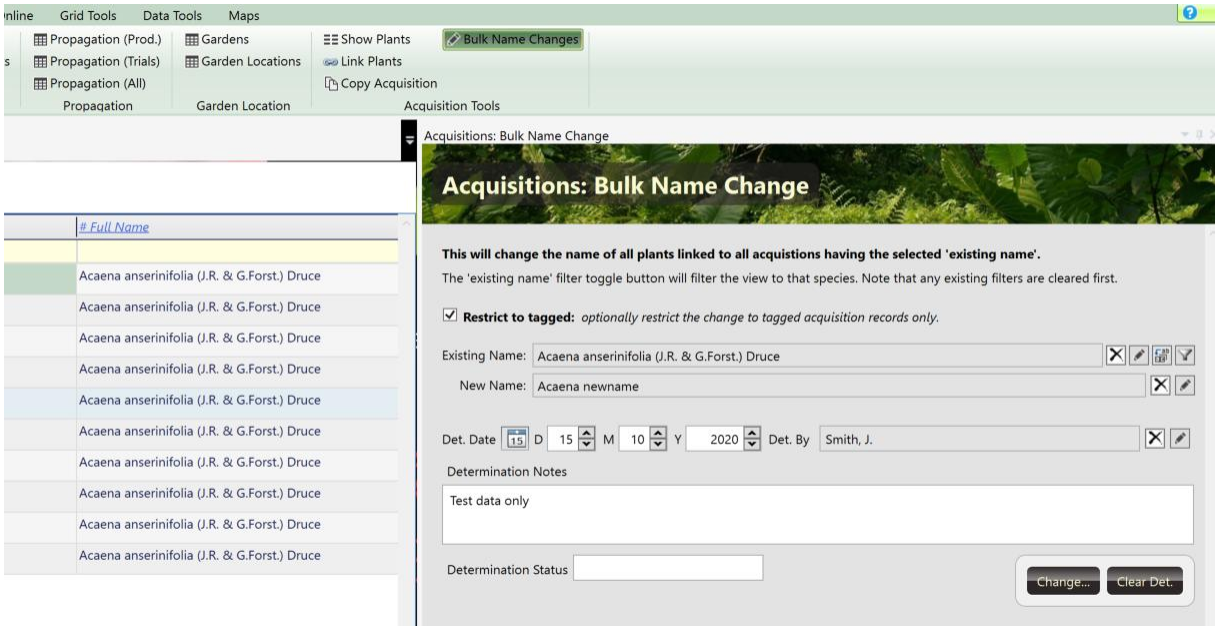


If changing a plant name, appropriate warnings are given if there is > 1 plant linked to the same Accession. If there are > 1 plants and you opt to split the Accession, a new Accession record is auto-added with the newly selected species name and the selected plant is linked to this new Accession.

Bulk name changes

In the event that a species name is changed in the main taxa table, this may require that one to many living collection accession records are also changed. The species change may impact on all or only some of the related accessions. For example, a species may become a synonym of another name or it may be split to different taxa.

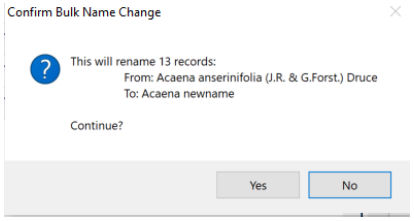
To update accession records, open the living accessions table and select the **Bulk Name Changes** option on the Collections menu toolbar.



Bulk Name Change form

Using the options provided opposite the existing name, you can lookup the name to be changed, set that name to the name of the current accession record, and filter the accessions to the currently selected name.

After selecting the New Name, you can then select **Change** to update the accession identifications for all or tagged records.



A prompt asks you to confirm the name change.

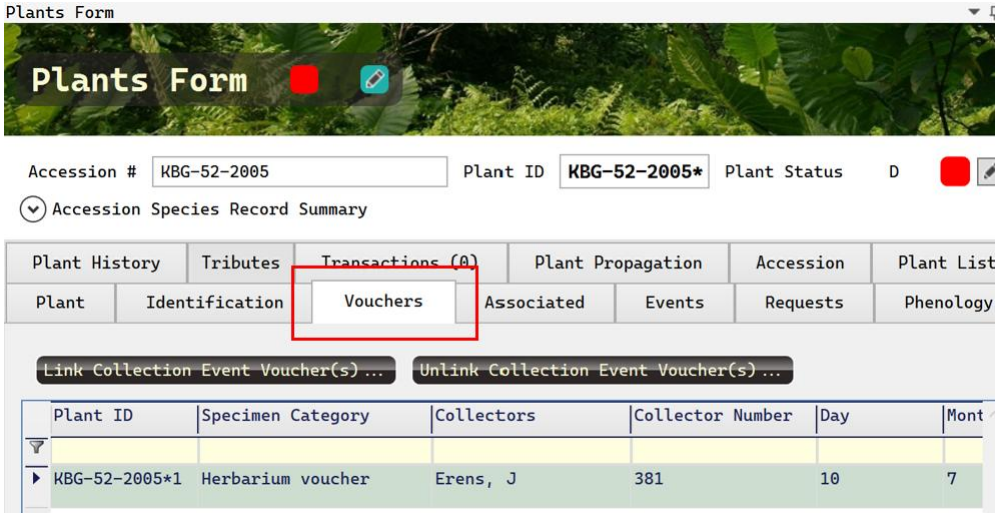
When accessions are changed, the records are tagged 'N' and a determination record is added for each edited record. Also, the relevant plant records are tagged 'N' and a name change event is added to each plant. The plant record tags can then be used to control label printing as required. Plants are edited regardless of their living status.

Collecting vouchers from garden plants

Specimens may be collected from garden plants for reference, checking identification and for other research purposes. Links can be created between the garden plant and the Collection Event tables allowing you to track which plants have vouchers. Vouchers may be of any type (herbarium specimens, DNA, wood samples, fruit or flower specimens, *etc*. These links are cross referenced within BRAHMS.

A given garden plant may have many vouchers collected over time. The flowering and fruiting status of collections can be added, thus helping you to determine if further collections should be made.

Vouchers are linked to plants using options provided on the Living Collections Plant Form **Identification** tab.

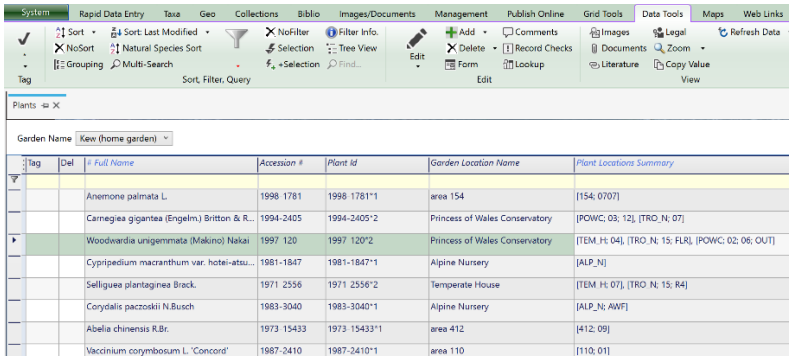


The plant form showing the Vouchers tab. This plant has 1 linked voucher. Options are provided to Link and Unlink vouchers.

Linking vouchers will open the form to locate a collection event. If the collection event has 1 or more linked specimens, these will all be added to the plant – voucher list.

Plant Location Summary

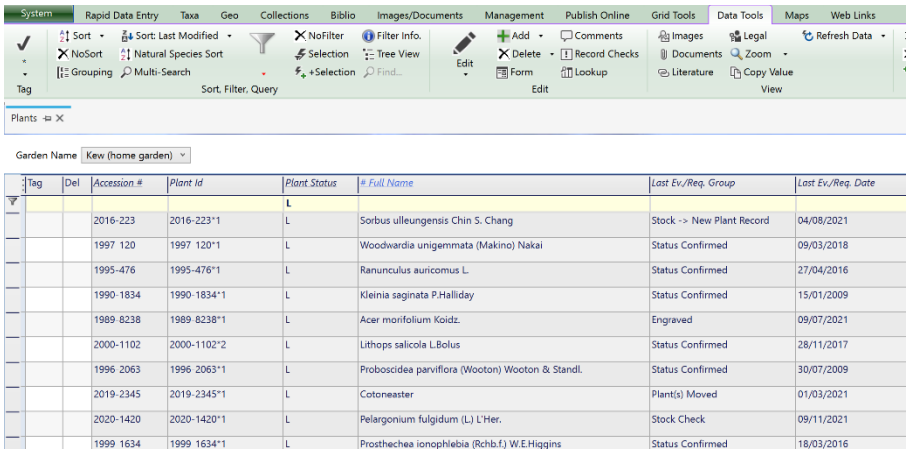
The field 'Plant Locations Summary' shows a list of all plant locations for the current accession. Although you can list plants on the plant form, this field is a useful guide to see where else a plant occurs in your garden. This list is restricted to Alive plants.



The Plant Locations Summary field lists plant location codes (including subareas) for the current accession.

Last event/request date and edit category

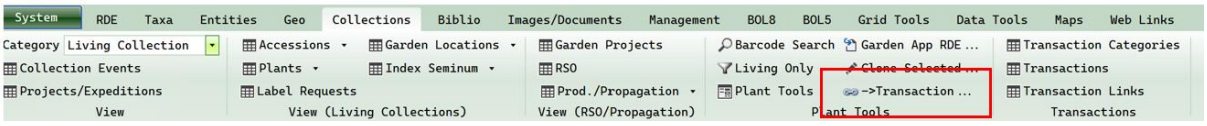
The Last event/Request date and group fields are useful indicators of what a plant was last assessed. The 'group' refers to the group category of the event or request.



Filtering of the last Ev/Req. date may be a useful way to select plant for inventory checks.

Linking plants to a transaction

With the main plants table open, select **Collections > -> Transaction**.

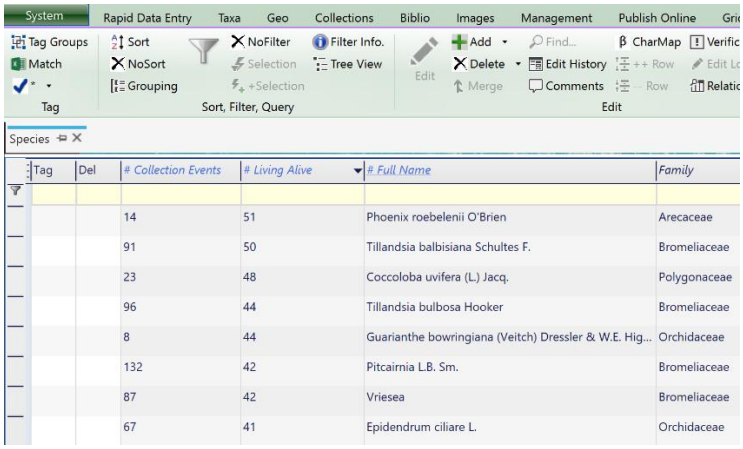




Using this form, you can select plant IDs one by one, to link to the selected transaction. You can select an existing transaction or add a new one. Using this form, you can deduct from plant stock using the Dispatch Quantity field. However, if you tick 'This material in NOT plant stock', the function does not deduct from plant stock. This may be appropriate when e.g. distributing seed. You can also auto-link all tagged records to a transaction. The restriction status of plant material is displayed on this form.

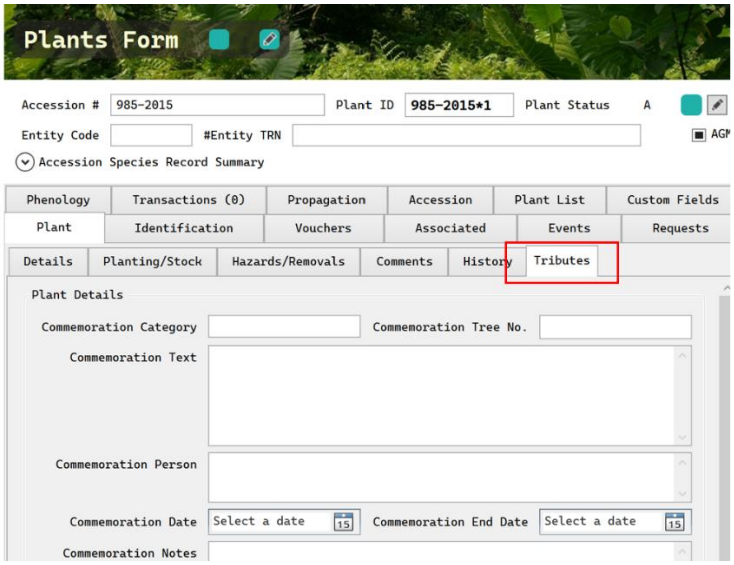
Calculated fields for plant records

The species and plant tables have a number of plant-related calculated fields updated using the standard process to update calculated fields. 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.



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.

Sponsorship, commemoration and tributes



Individual plants can have commemoration/tribute texts added. You can also design a field view to include the relevant tribute fields.

Tagging in the plant table

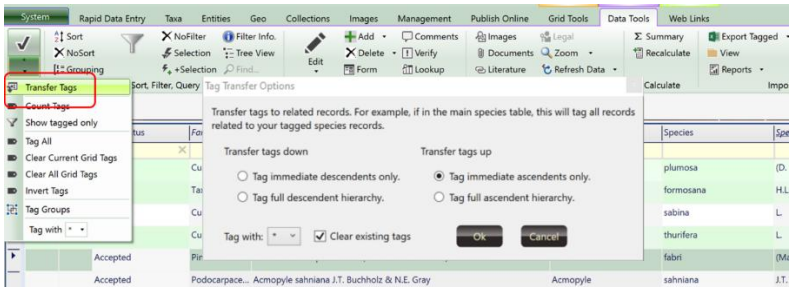
The use of tags in the plants table is fundamental to many operations. Tagging in general is described in the manual section on Tagging functions. A few example uses of tags are provided here.

Using tag groups with plant records

The Tag Groups function can usefully be used with plants to create groups of plants of special interest. Any selection of plant records can be tagged and this then used to create a named plant group.

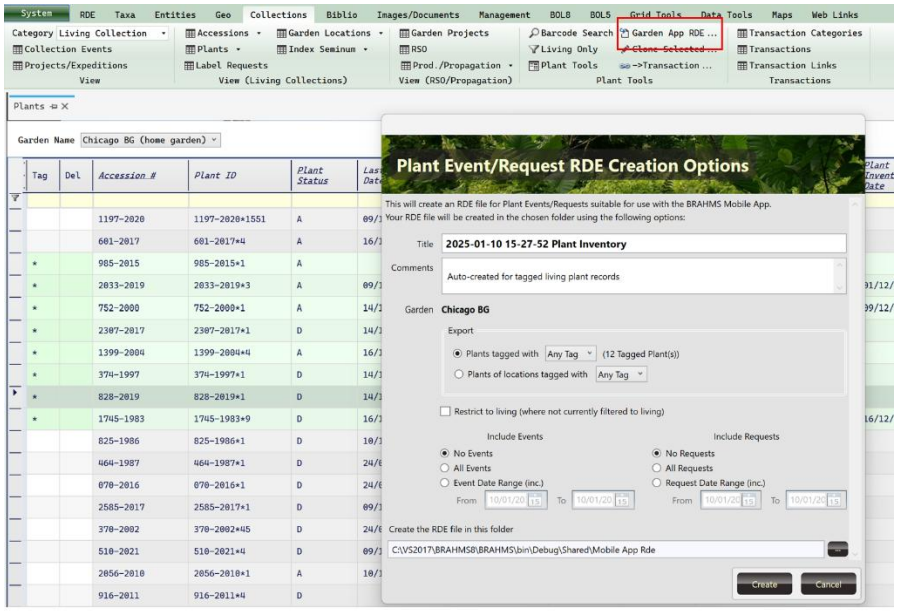
Tagging plants based on tags in other tables

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 you have created such as '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.



Creating a plant RDE file for the Gardens Mobile App

In the main plants table, tag the records you wish to send to BRAHMS garden app. Typically it will be plants in a selected garden location. You can export existing events/requests for the selected plants - so that these can also be viewed in the app. Existing images are not exported. You can also restrict plants to those with a status representing 'alive'. If you have tagged one or more records in the garden localities table, you can also use the option to Export all plants of tagged locations. Once created, the next task is to copy your RDE survey file(s) to your device.



For further information, refer to the garden app documentation.

Plant Events

Introduction

Living collection plant event records are used to record things that happen to plants from their accession through to death or disposal. Examples are plant status changes, 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

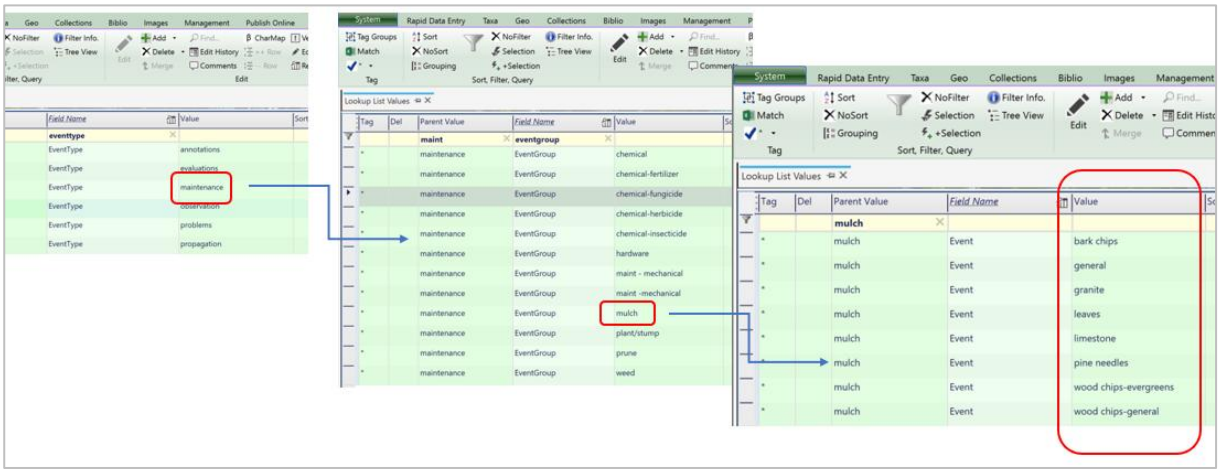
Events are categorised in a user defined, 3-level hierarchy:

PlantID	The event record displays some fields from the parent Plant file including the ID itself, the species location.
Event Types	**This is the top grouping level – thus there will usually be a small number of entries. Examples are Inventory, Maintenance and Observation.**
Event Groups	These are division of the main event types. Thus, for maintenance, you may have entries such as Fertilizer, Herbicide and Mulching
Events	These are the final category which would be, for example, the different types of mulching such as bark-chips, pine-needles or limestone.
Event Date	Separate into Day Month and Year fields.
Result	Where relevant, a text or numeric entry relating to the event, for example a measurement.
Event Person	Who carried out the event
Event Notes	Text description of event

Audit fields	Added by, Added When, Last edited, Last Edited by

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.

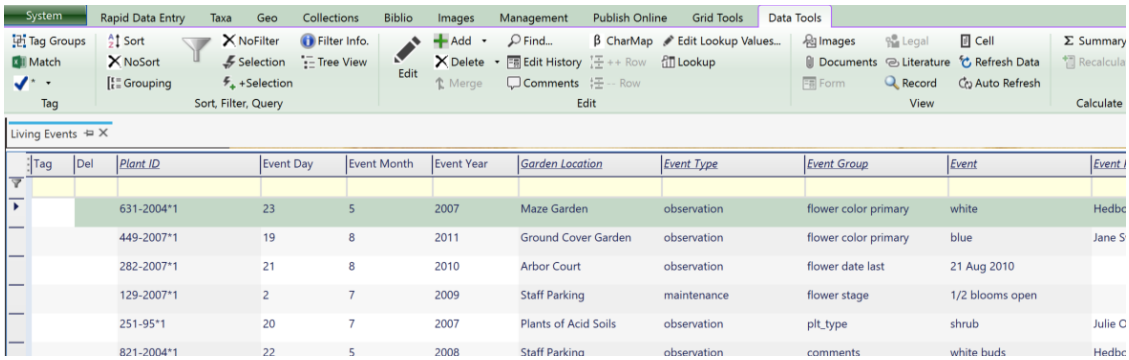
Typically, the top-level **Event Type** will consist of a short list. An example entry could be 'Maintenance'. This is the top level in the event hierarchy. Note that the Field Name is set to EventType and there is no entry needed in the Parent Value field.

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 categories of '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.

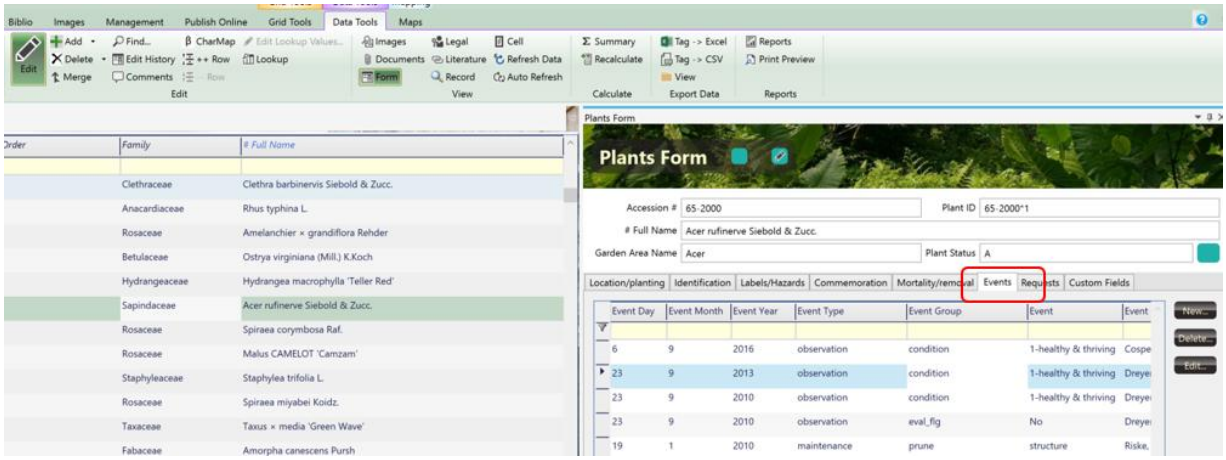
Editing Plant Events

Events can be edited directly from the main Plant Events table opened using **Collections > Plant Events**.

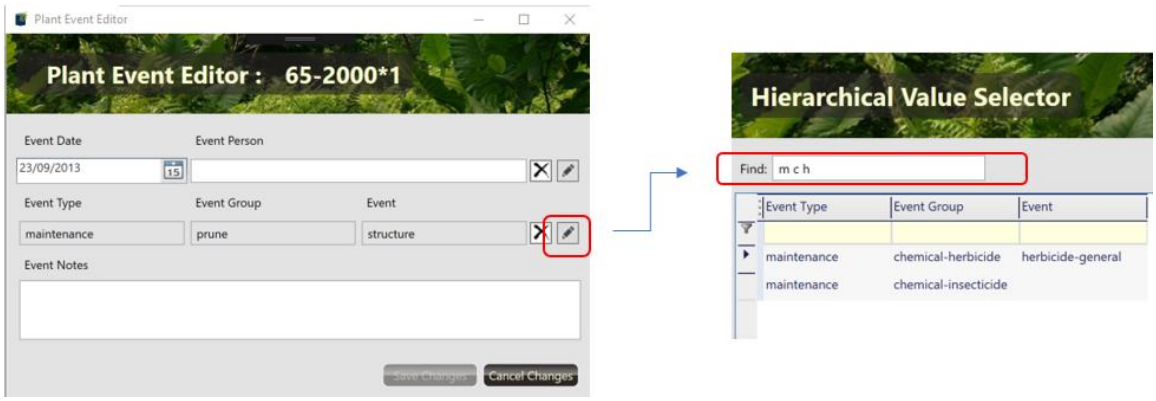


Events can be added and edited directly in the events table. If you add a new record, you are prompted for the plant ID. Several fields from the plants table are displayed but cannot be edited in the events table.

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.

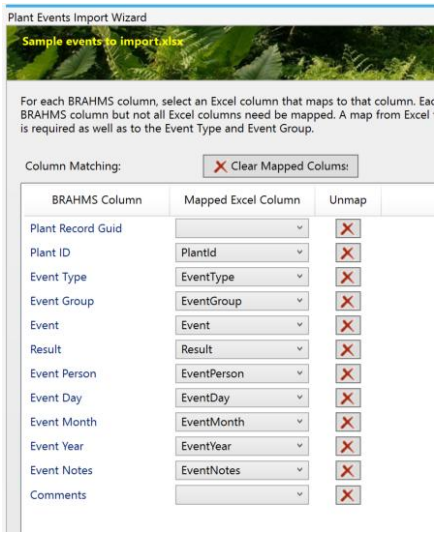
Importing Plant Events from Excel

Currently, there is no RDE for plant events. However, event data for plants already stored in BRAHMS can be imported to the events table directly from an Excel spreadsheet. The events can be of any type/group. Ideally, the event hierarchy options you use will the same as those registered in your BRAHMS lookup list.

To match to plant records in your database, the excel table must include either the plant record GUID or the Plant ID. If a match cannot be made on one of these columns, the data cannot be imported.



*The **Import Events** option is found on the Collections toolbar when the Plant Events table is opened.*



The Import Wizard allows you to match all the fields that you wish to import. In the above example, there is no GUID so matching will use the Plant ID.



The pre-import screen showing that one plant cannot be located and thus, the data for that record will be ignored.

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 Requests table opened using **Collections > Requests**. Alternatively, you can edit requests from the main plants table using the Requests tab on the form.

Registering and producing plant labels

Introduction

The following guide entry applied to BRAHMS v 8.6 onwards.

As a rule, two main categories of labels are produced in botanic gardens: engraved labels and those printed on special paper/plastic for potting and similar. Both of these often on specialised printers. Both categories may have several sub-types based on the precise type of label needed, including label size. This section discusses aspects of label production from the initial request to the final production.

Labels may be produced for existing garden plants and/or for species that do not necessarily have plant records. Thus, garden labels can be created directly from the living collections plants table and/or the main species table. Clearly, in the latter case, there will be no reference to accession or plant record details.

Key points

- Using the in-built reporter, labels can be printed directly from BRAHMS or saved to one of several formats such as Excel or PDF. These reports will be based on one or more report templates that you design.
- Labels can be processed for plants and or species. For example, you may want to print labels for display plants that are never accessed to the main accessions/plants tables.
- Data for labels can alternatively be exported directly to Excel, based on one or more data grid column views. Such exports may be required for certain types of engraving printers.
- You can add as many label categories as you need, each associated with a report template or a data view.
- Labels are often required, not only for new plants but when plants change name, have their name verified, or are split to new areas. The tools that offer these functions in BRAHMS include a direct link to label production for the relevant plants.
- Labels can be printed directly or alternatively, added to a central label request table. Direct printing by-passes the label requests table. The enabling of direct printing is an option when saving a label template.
- There is a concept of 'deferred label printing' which is used when the print job has to take place after a certain action is completed. For example, if you are adding new plants or splitting stock, the new Plant IDs must be created before the labels can be produced.
- Permissions can be assigned on a user-by-user basis as to who is allowed to request labels. Thus, a garden with many horticultural staff may wish to restrict this function to selected users and thus more tightly control the build-up of costly engraved label requests.
- Labels added as requests are processed from the dedicated request file and their status changed from pending to processed.

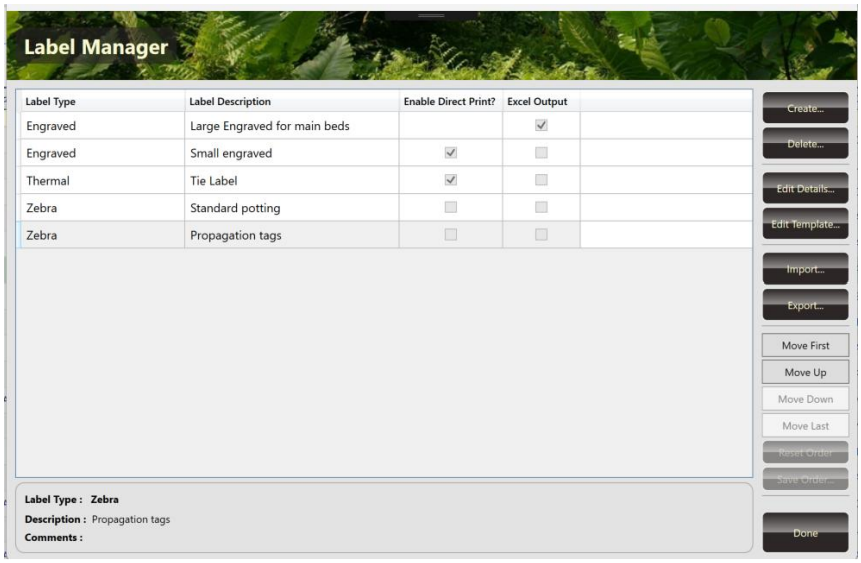
Registering your label categories

Species or plants

As a first step, you need to register your categories of garden label in the Labels table. You can select:

- **Taxa > Species** – then on the Taxa toolbar and select **Label Templates…** – or
- **Collections > Plants** (when the category is set to Living Collection) and then on the Collections toolbar select **Label Templates…**

These options lead to the same Label Manager form.



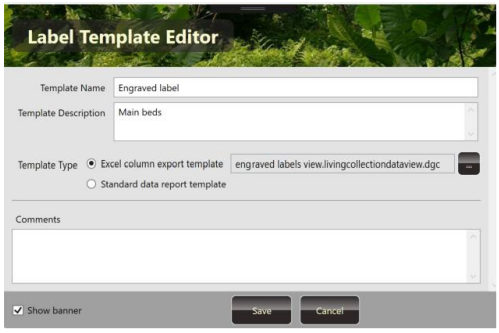
Label Manager for species and plant records.

Using the Label Manager, you can create, edit and delete label templates; Import templates from existing report (.mrt) files; export label templates to share with other projects. Access to the Label Template form is permission controlled.

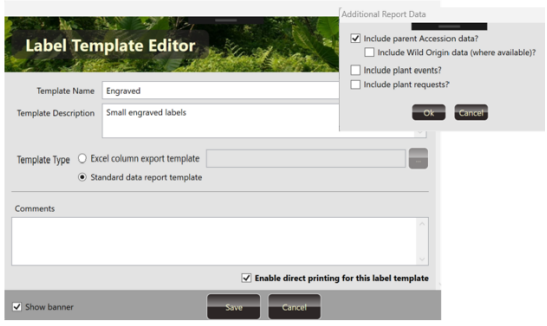
Label templates are stored within your database and thus, there is no need to locate external .mrt report template files (as there was pre v8.6) nor set any report folder locations.

Create new label template

If you create a new template using the Excel output option, you will be asked to select a saved data grid view file.



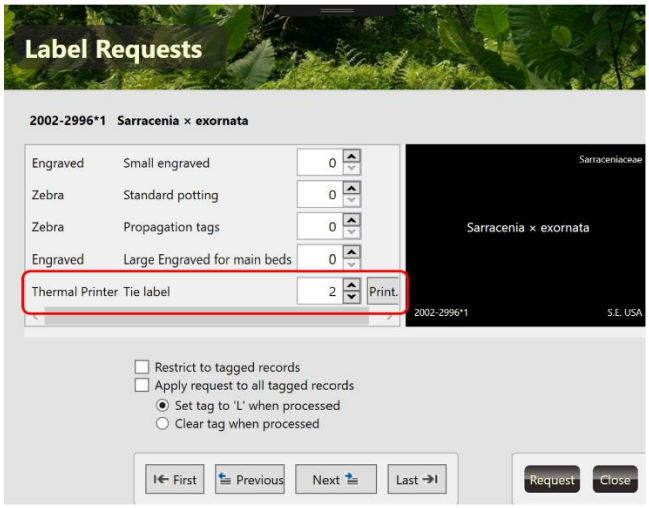
Select any saved column view (.dbc) file to associate with the Excel export template entry.



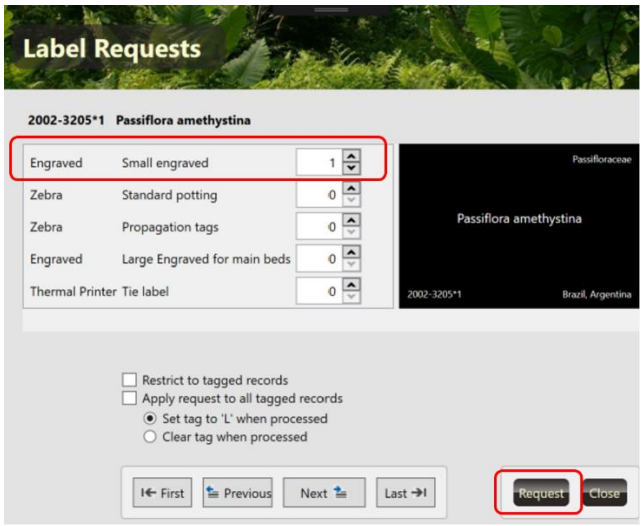
When creating a standard report template, you can optionally refer to data in other tables.

Enable direct print

On the Label Manager form, the option **Enable direct Print** can optionally be selected. If selected, users will be able to by-pass the label requests table and print directly using the label print options (see below). If this option is not selected, the label print task is directed to the label requests table.



When Direct Print is enabled, a user can print labels directly – rather than being forced to submit a label request.



When Direct Print is not enabled, a user must request labels. In this case, the label request entries are added to the Label Requests table.

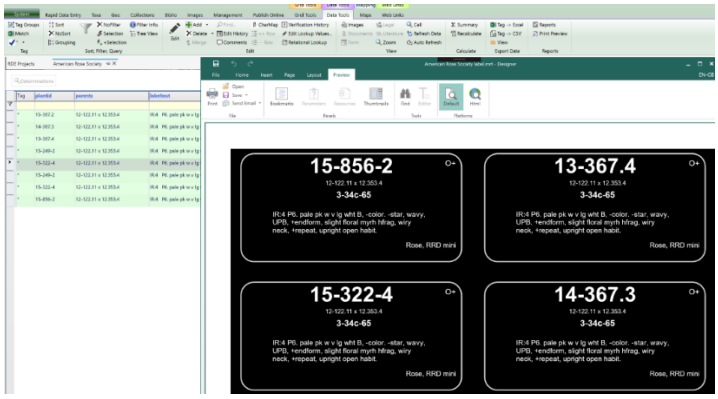
Excel Output

If Excel Output is selected, the label requests do not use a standard report template. Rather, when printed, the data are exported to an Excel table based on a saved data grid view. You can register the saved view in your database in the same way a report template is registered using the option provided.

Editing a report template

If you have created a label entry template as a standard report template (not Excel Ouput), the **Edit Template** option opens the report editor. If you have created a label entry template as Excel Ouput, the **Edit Template** option allows you to select a saved grid view (.dgc) file.

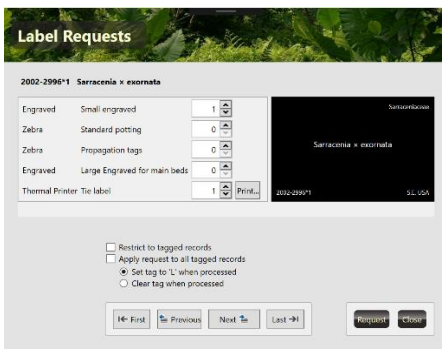
Reporting design options are integrated with BRAHMS and are described in the reporting section of this guide.

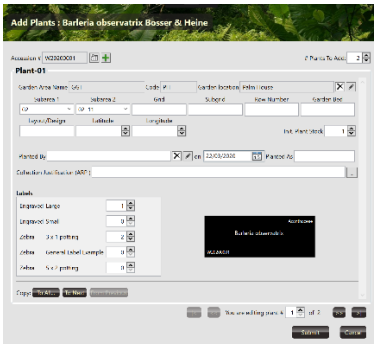


You can design multiple reporting templates for different categories of label and either print directly or export to different formats.

Producing plant labels

Labels can be made directly when adding new plants and also when using various tools on the Collections toolbar such as the **Print/Req. labels**, **Identification** and **Move/Split**, all of which include options to print/request labels.







Your registered label categories are listed on all forms that have a link to label printing including Print/Req. labels; Add Plants; and Name checks/Changes.

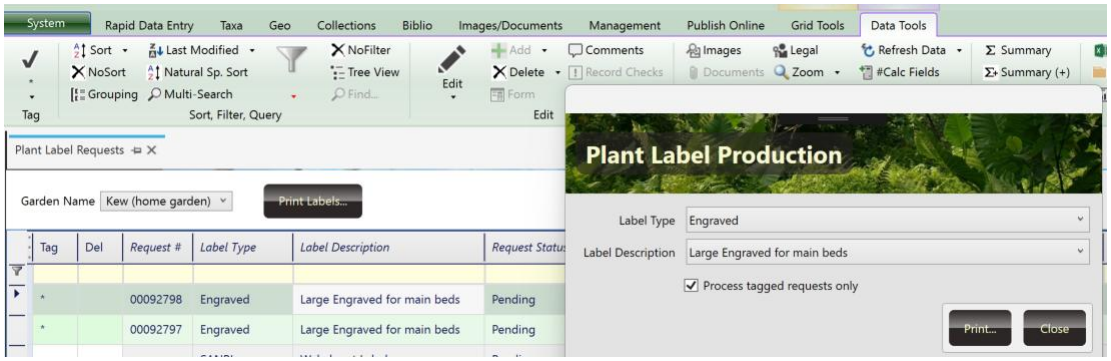
Processing label requests

When labels are requested, they are added to the plant requests table. The requests table can be opened in a special mode for processing label requests.



Pending label requests are displayed in this table together with the label type and quantity.

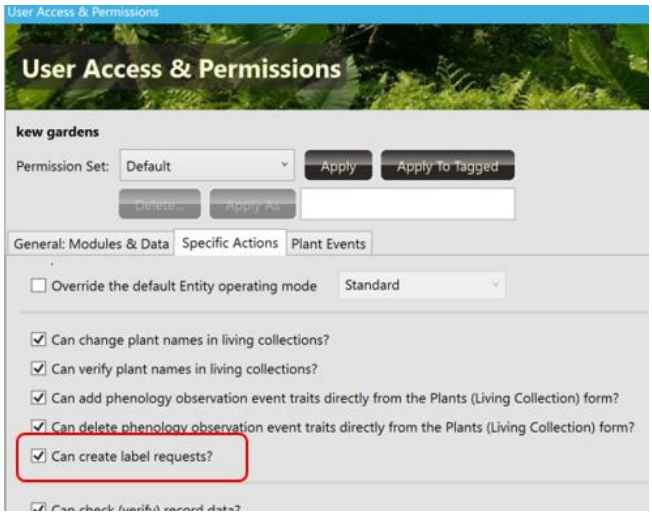
To process these pending requests, select the **Print labels…** option.



The print option asks you to select which category of label to print.

Permission settings

A permission setting is provided on the User Access and Permissions form, **Specific Actions** tab to allow a user to request labels.



If this option is not set, users will be able to use direct label printing but will not be allowed to add requests to the label request table.

Index Seminum

Introduction

Botanic gardens and related projects that develop a seed catalogue and distribute their seed to other gardens may wish to use the Index Seminum features provided in BRAHMS. Index Seminum catalogues can be built based on accessioned and non-accessioned material for wild or cultivated plants. Facilities are provided to:

- Create named Index Seminum (IS) catalogue entries, often one per year, with descriptive data held under user-definable headings.
- Link Accessions records to selected IS entries.
- Add non-Accessioned material to selected IS entries.
- Select Accessions that are linked to an IS entry and link these to one or more Transactions.
- Create Transaction reports with IS item lists directly from your IS table. Reporting can be used to generate PDFs and other output formats.

Adding a new Index Seminum record



Select the **Index Seminum** option on the Collection menu. After adding a new record, here, you can add in the Garden name, the index Year and Title, and up to 5 text headings and values. For example, you may want to add text describing the growing conditions and climate of your garden; special notes about the catalogue for the current year; contributors; and any other relevant details. All of these text headings and values can be formatted into your Index Seminum report.

The table also has a form with tabs for the above data and a separate tab to list, add or edit seed entries.

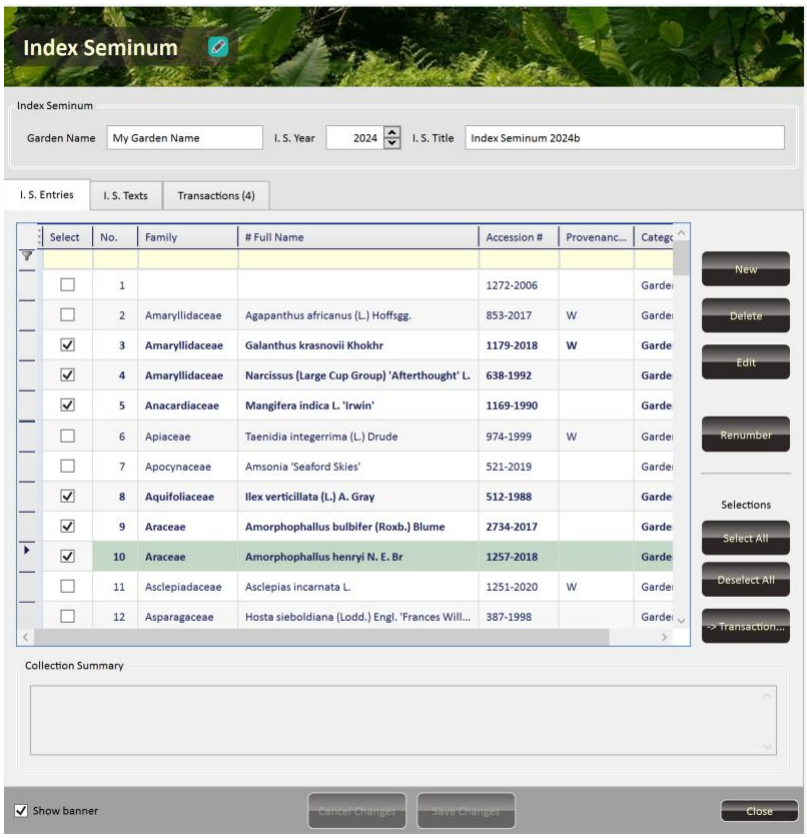
Adding index Seminum item entries

Index item entries (*i.e.* accessions/species that you are supplying seed for) can be added directly to the above form using the various lookup options provided. Note that you can add entries that are not accessioned in your database. For example, you can add an entry by looking up any species name registered in your species list.

Typically, you will want to generate Index entries based on your existing Living Collection Accessions (*i.e.* the source of the seed to be distributed). To do this, tag the relevant Accession records and then choose the option **Collections > Tagged -> Index Seminum**.



Listing index entries and linking to transactions



Use the Index Seminum table form to list all of the linked IS entries. You can select IS entries using the tick boxes to link to a transaction using the option ***->Transaction****. The same index list can be used to create multiple transactions.*

Renumbering index entries

On the main Index Seminum form, use the **Renumber** option to renumber the entries sorted by family + species name.

Index Seminum outputs

All data from the index can be exported to CSV/Excel in the normal way. You can also design report templates that format the index and index entries as you wish and save these reports to PDF, HTML, Word, *etc. a*s well as printing them directly. Typically, reports will be produced for transactions with the name/address of the institution receiving the seed and the list of items to be dispatched per transaction. You may also wish to print labels for seed packets. Sample IS reports can be provided on request.

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.

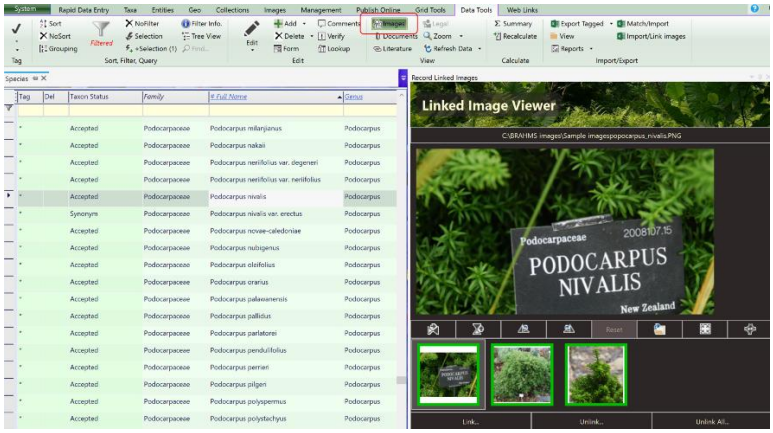


Image management is discussed in the image section.

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.

Adding phenological observations

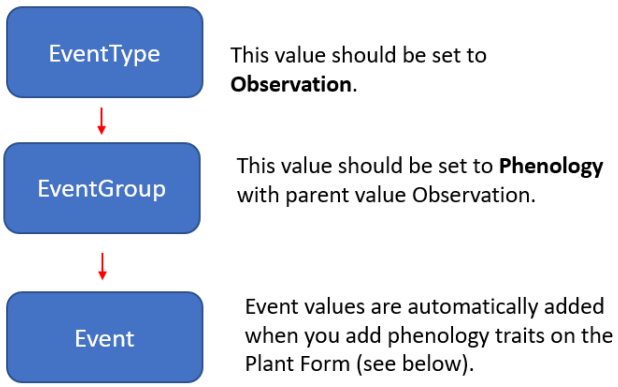
Introduction

The phenology options enable you to record phenology events for individual plant records. These are indicated by adding the present or absence of a selected phenology event by date. Any phenology event can be registered, examples being flowering, fruiting, seed set and leaf flush. Phenology events can then be summarised by month.

Setup options

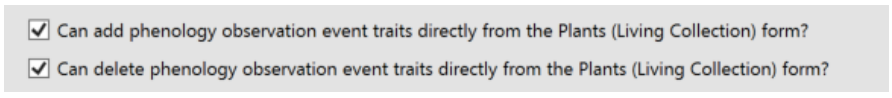
Register event lookup options

Events in BRAHMS are stored in a 3-level hierarchy: **EventType, EventGroup** and **Event.** While not strictly necessary to register event look categories, we suggest you add EventType and EventGroup as described below.



Permissions

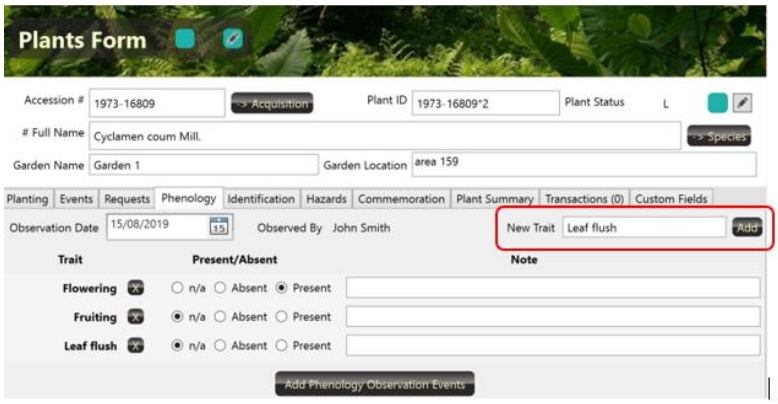
Users can be given permissions on **System > Manage Users and Permissions** as follows:



The permissions dictate whether a user can add or remove phenology traits. Any user with access to the living collections module can add/edit phenology data but not necessarily add/delete traits.

Adding and deleting phenology events/traits

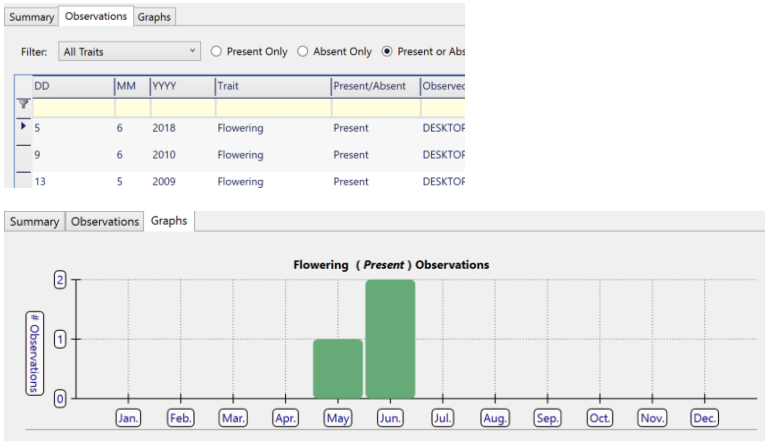
To add a new phenology event, choose the date and select Present/Absent for the listed trait, optionally adding a short note. All measurements can be added as either Present or Absent. All events, including phenology events, are deleted from the plant form main Events tab. A user with the appropriate permission can add a new trait in the New Trait text box.



Traits can be added and deleted from this form.

Summaries and charts

All phenology observations for a given plant can be listed from the Observations tab. These observations are stored as plant events and thus, can also be listed on the events tab together with all other events for the plant record.



Observations can be listed and viewed graphically.

Mapping plants

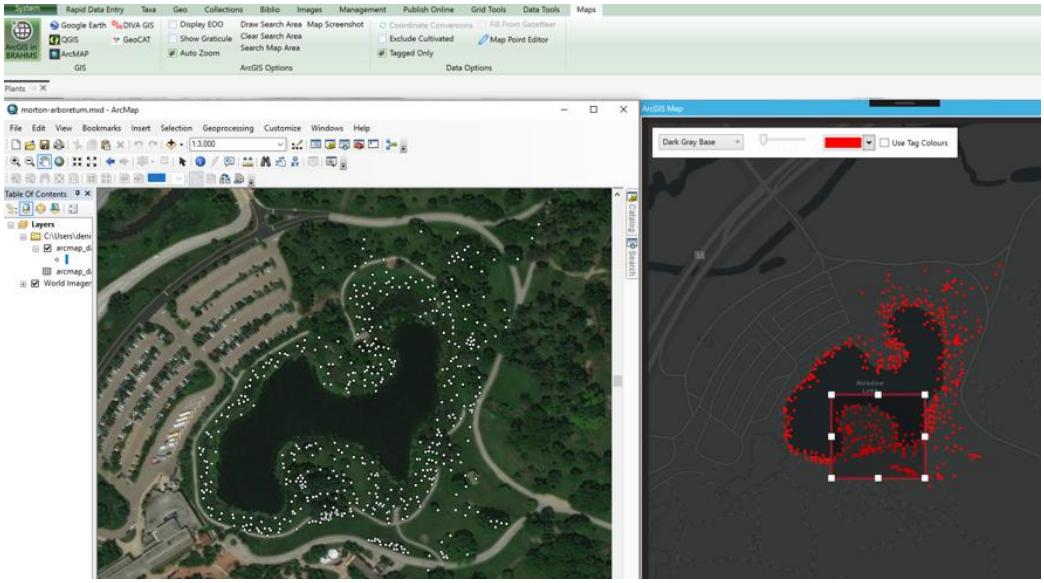
Mapping garden plants and their origin

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

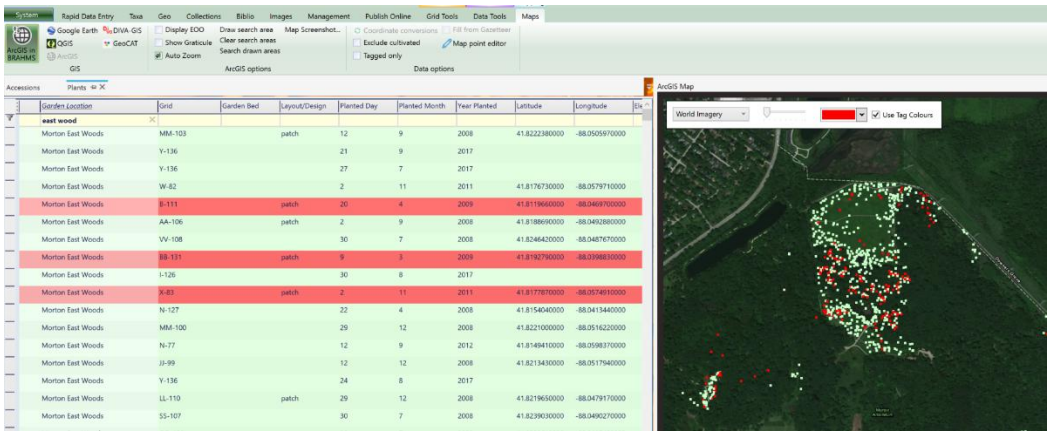
Mapping the location of garden plants only requires that your plant records have a latitude/longitude value. These can be entered in different units but are always stored in decimal degree format, negative for South and West. You can store these data with up to pin-point accuracy.

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.

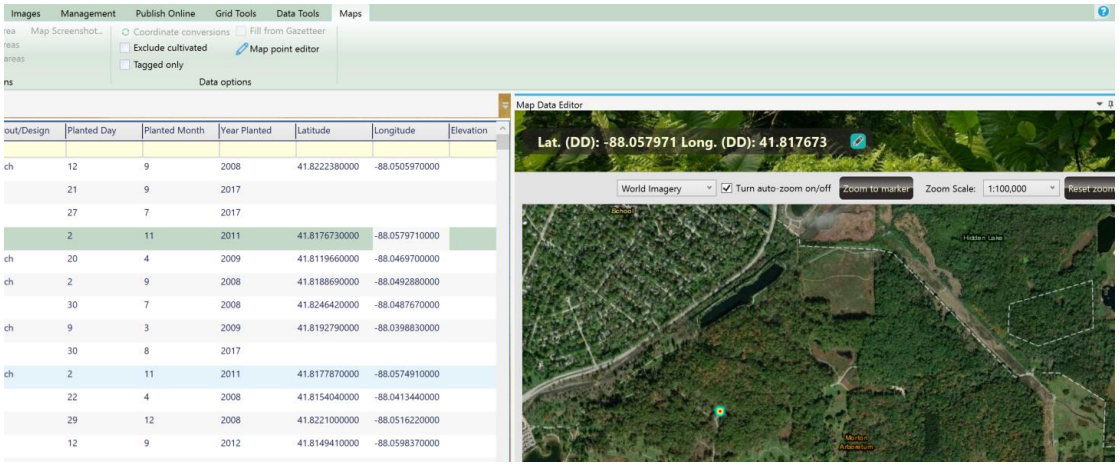


Garden data plotted to ArcMAP and the internal ArcGIS mapper



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.

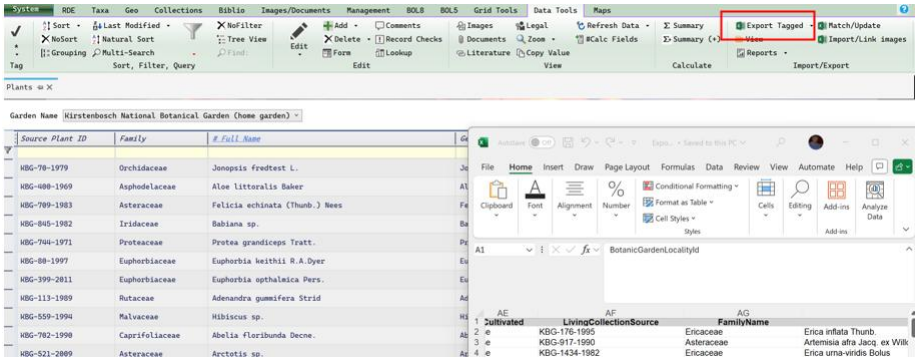


A right-click on the map moves the point and adjust the stored data point.

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.

Plant Requests, Scheduling and Ordering (RSO)

Introduction to Plant Requests, Scheduling and Ordering (RSO)





Succulent, Rudbeckia and Paphiopedilum production at CBG. Images provided by J. Hutchins, Chicago Botanic Garden (CBG).

The RSO module has been developed in collaboration with Chicago Botanic Garden.

The RSO options are used to manage requests from curators for new plants, be these seasonal/display or to be accessioned. Accessioned plants are registered in the Living Accessions table while seasonal plants are not.

Plant requests are submitted to a central RSO table where they can subsequently be processed in stages through to production/propagation/dispatch and optional garden accessioning.

As discussed below, there are a number of processing stages from the request submission through to the final delivery of the requested material.

Those responsible for scheduling and ordering the requests are able to optimise delivery dates to feed into propagation or production to meet required garden delivery dates. A curator may request a species that does not exist in the institutional species list - and this would require addition by someone with authority to do so.

It becomes possible to streamline the ordering process by combining requests for different species and from different curators into single orders form a selected vendor.

Action	RSO Status
Request is rejected by management	Rejected
Request is accepted	Pending
Species are checked and confirmed	Approved
Vendors are checked and confirmed	Approved
Schedule date selected	Scheduled
Order date selected	Ordered
Receive date selected	Received

Summary of RSO status stages.

The RSO table and manager

Introduction

The main RSO table is opened using **Collections > RSO** when in living collections mode. Note that by default, archived RSO records are hidden.



The main RSO data grid.

The RSO grid can be edited as with any other data grid. Some fields are read only. The RSO has a special **Manager** which is opened using the **Show/Hide RSO manager** option.

Linked Propagation-Production records

When new RSO records are created, a record is automatically added to the Propagation/Production (PP) table. This is linked to the RSO record with the same RSO/Propagation number. This provides a close integration between these two tables - and it also means that certain PP fields can be viewed and edited from the RSO table. These are mostly 'forecasting' (see below) fields.

Data fields that are visible in the RSO table but are stored in the PP table can only be edited in the RSO table via the RSO Manager. In the RSO data grid, these PP fields are read-only.

Plant requests – RSO data capture using Rapid Data Entry (RDE)

Curators will normally submit plant requests in batches using RDE files. RSO RDE files are created and edited as are all other categories of RDE file. The following data fields are available in the RDE table for RSO submissions:

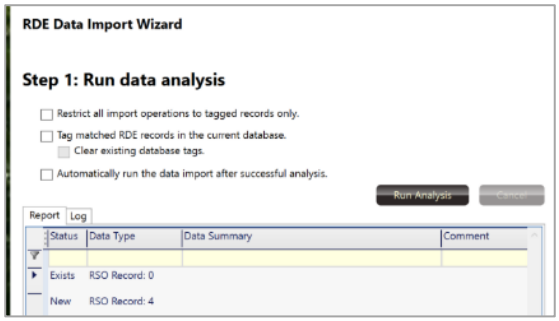
Field	Note
RecordId	Calculated RDE record number – not for editing
Garden Name/Code	Lookup to your garden name/code
Requested By	Person ordering plants – lookup to name strings table
Requested For Garden Location/Area	Requested destination of requested plants
Garden Project Name	Link to Garden Projects table (see below)
IsAccessionMaterial	Is the material to be accessioned rather than seasonal/display only?
IsPropagationMaterial	Is the material going to require propagation?
Is Wild Collected	Is the material wild collected?
Requested Material	Bulbs, Seed, Plants, etc.
RequestSpecies	Requested Species – look up list or added as new
RequestDeliveryContainer	Lookup to container categories (see below)
RequestDeliveryPlantsPerContainer	Requested plants per container (normally 1)
RequestDeliveryContainerQuantity	Request number of containers
CalcRequestDeliveryPlantsQuantity	Calculated field based on containers x plants per container
RequestedForDate	The date the material required for final delivery to garden
RequestVendor	Requested vendor (may be adjusted by ordering team)
RequestItemNumber	Vendor catalogue number if known.
RequestUnit	Unit name e.g. Each; One L pot; Pack of five,
RequestUnitCost	Unit cost
RequestUnitQuantity	Requested number of units
CalcRequestItemTotalCost	Calculated cost of item
ResearchCode	Optional code for research of budget line
Comments	Additional notes

Importing RDE files

Once an RDE file is prepared, the curator responsible (or another designated to do so) will proceed to upload the data from RDE to the central RSO table in BRAHMS where the request will be processed by the plant scheduling/ordering staff.

RDE file uploading is prevented if any of the following fields are null or have empty string values:

RequestedBy
RequestedForDate
RequestSpecies
CalcRequestDeliveryPlantsQuantity



Import analysis indicates how many new RSO records will be added.

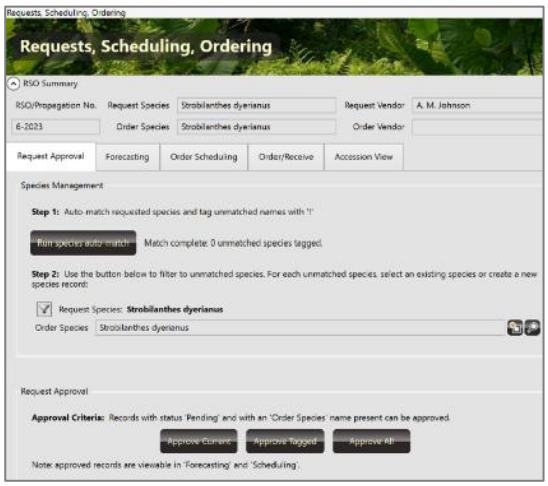
As part of the RDE import, new RSO/Propagation numbers are auto-assigned based on your configuration settings (see **System > Options > Living Collections > Production/Prop** . This same number is carried through to the propagation-production table. Note that there is an optional *Auto-Archive* RDE files on import feature.

Once imported in this way, the records in the RSO table are assigned a status 'Pending'. A key next step is to check the species names as requested and approve the requests.

Request Approval

Species checks

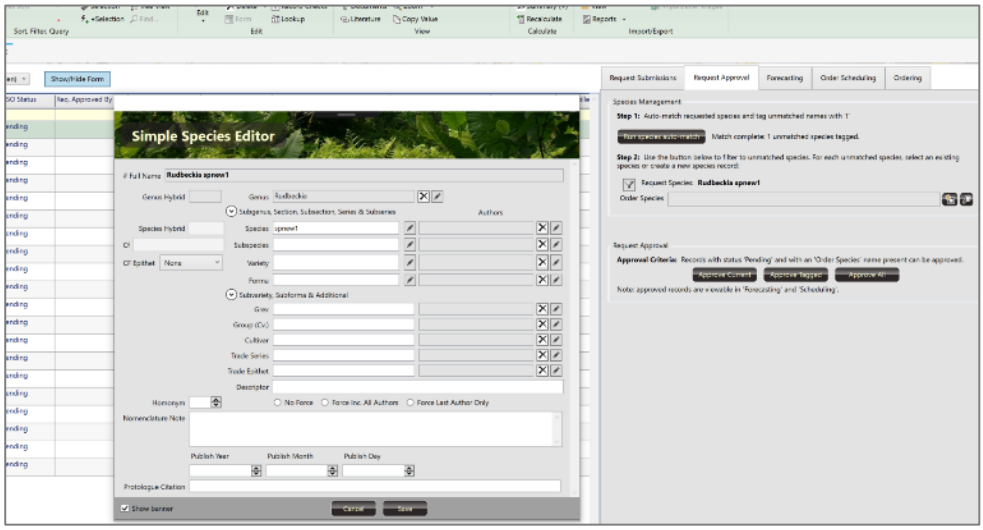
The next stage is **Request Approval.** Before approving submitted and accepted records, the species names must be checked using the **Species Auto Match** tool. This tags with "!" any taxa that cannot be located in the main database taxa table. This may be an incorrectly added species or it may be a species new to the institution/botanic garden.



The RSO manager Request Approval tab. Note that the Auto-match result is given in summary (e.g. '0 unmatched species') next to the auto-match button. In this case, all species have been located in the species table.

When one or more species cannot be located, there are three choices:

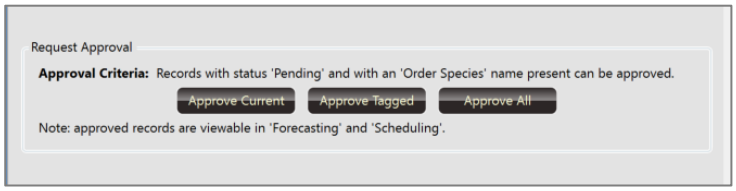
- Leave the record unedited and thus it cannot be further processed. You may choose to delete.
- Edit the species name by selecting a correct name from the species table using the option provided.
- Add a new species to the taxa table using the option provided. Note, you could, if needed, go to the main species table to further checks/add new record directly there – and then return to the RSO to re-run Auto-match.



When adding a new species, BRAHMS will parse out the submitted name as best it can. The name can then be edited and added to your main species list.

Request Approval

Once the names are checked, you can then 'Approve' the requests using the options provided. **Approved** names have their status changed to 'Approved' and they will disappear from the main data grid. Once the RSO Manager is closed, these records will be visible again.



Also, at this stage, when records are approved, species default data, if available, is pulled into PP forecast fields. Default species propagation values are discussed below.

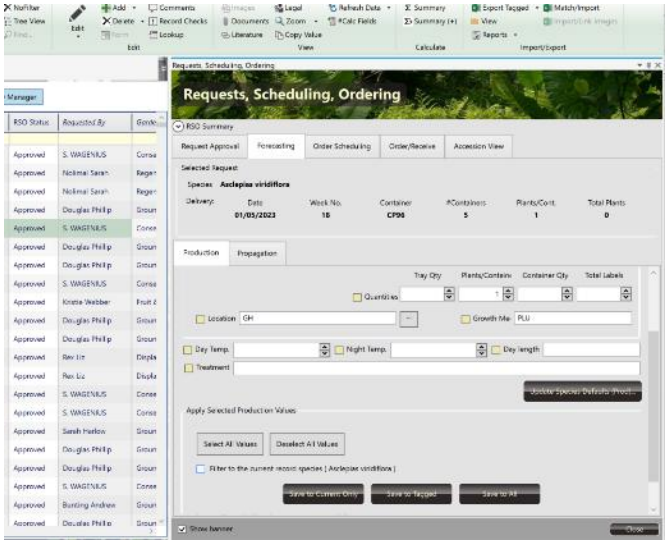
Forecasting

Forecasting – Production



Propagation plug trays at CBG. Knowing space requirements in advance (forecasting) can be critical for planning. Image provided by J. Hutchins, Chicago Botanic Garden (CBG).

Forecasting data, stored in the PP table, are visible in the RSO table. In RSO, they can only be edited via the manager. These fields are generally used to help order planning and scheduling. For example, it may be essential to have an advanced idea of the growth space, growth medium and temperature requirements for in-coming plants. These can be used to determine what greenhouse space will be used for a crop. For example, a crop needing 60/55 day/night will need to go in a different house than one requiring 75/70.

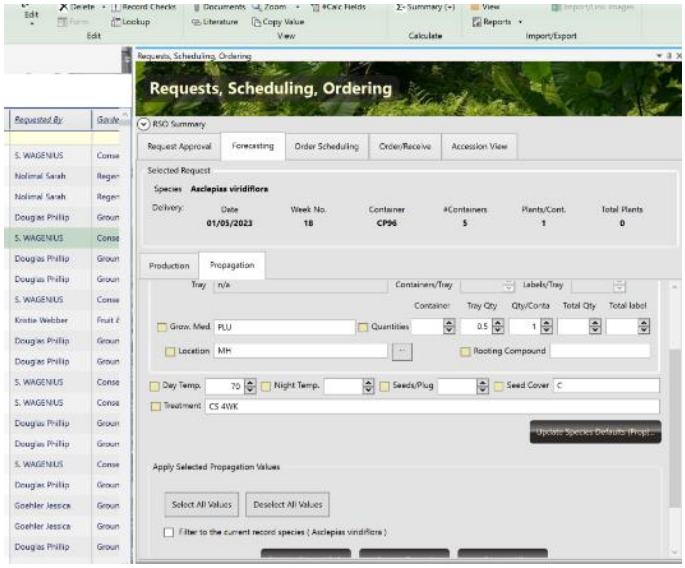


The top part of the Forecasting form shows the Requested data. The main part of the form shows the Prop-Prod data, auto-filled with species default data values. The data shown above are fictitious.

Data in the Forecasting form can be edited. The edits made here can be saved and copied to one or more other records using the **Tick boxes** and the **Save** options. For example, the Production Growth Media may be edited from the default in one record – and this edit applied to other records. Note that many of the values on this form will be provided from standard lookup lists.

Forecasting - Propagation

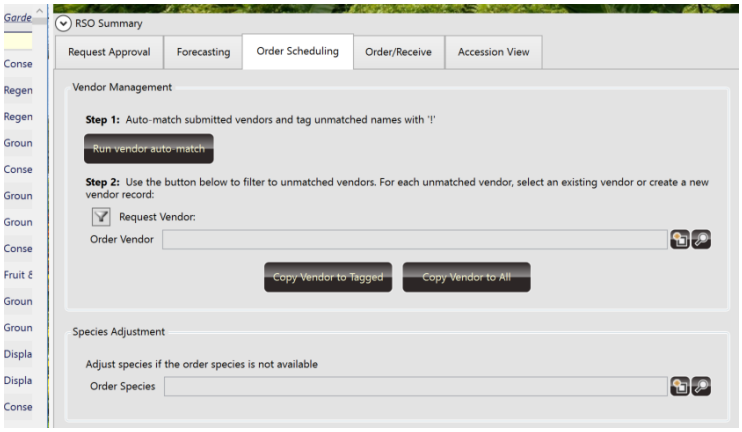
This is similar to the above form except that the data are limited to records being propagated and the form fields are for propagation data.



Order scheduling

Vendor matching

On the Order Scheduling tab, the task is to run the **Vendor Auto-match** tool and to add and/or adjust vendors as needed. The vendor matching uses the 'Requested Vendor' and adds the result to the 'Order Vendor' field.

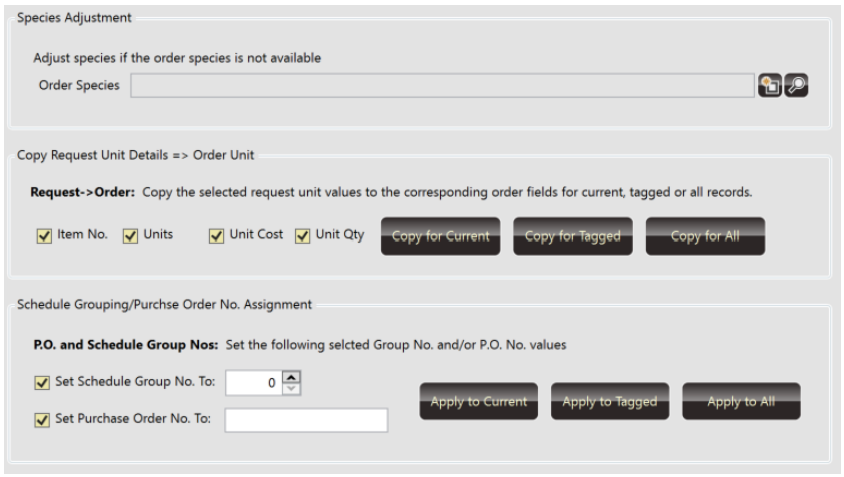


The Auto Match vendors tool checks the requested vendor names and marks up and new/unknown entries.

Note that a Filter tool is available to filter the RSO records to unmatched vendors. To filter on any selected vendor, use the grid filter row. There are also tools to copy Vendor to tagged or to all (within a filter) records.

In order to edit fields such as Order Item No, Order Unit Quantity and Cost, the data can be edited directly in the data grid when in edit mode.

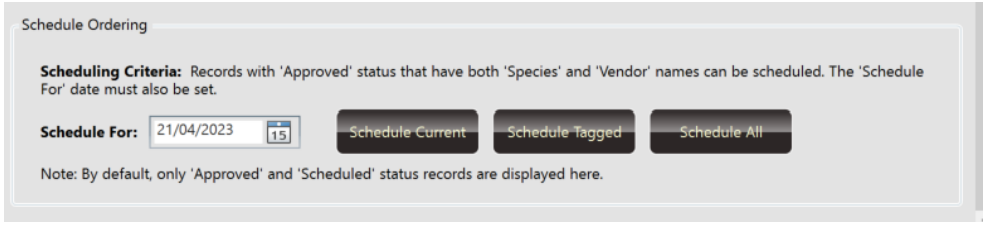
Order adjustments



Various features are provided to help with the ordering process. For example, at this stage, the selected species can be adjusted.

Scheduling Orders

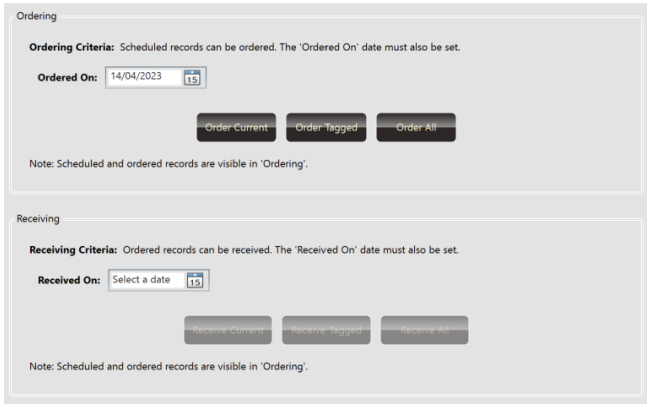
At this stage, the task is to add the order dates. The date added can be applied to the current record only, tagged records or all records. Bear in mind, filters are respected. The RSO status is changed to 'Scheduled'.



Ordering and Receiving

Ordering and receiving

Order dates can be adjusted record by record, applied to tagged records or to all records. The RSO status changes to ‘Ordered’.



When received, the records can be marked accordingly and the RSO status changes to received.

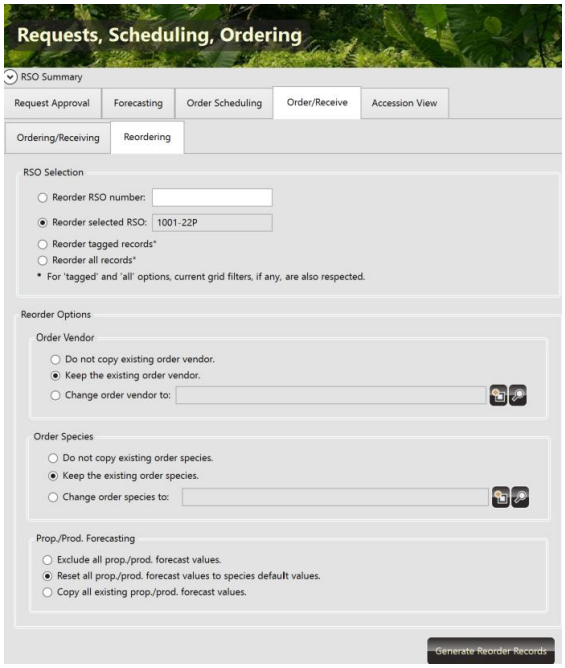
Receiving Accessioned material

The option here is used to auto-create new Accession records for material indicated as ‘Is Accession Material’.



Re-ordering

Material can be re-ordered using the options on the Reordering tab.



Various options are provided to copy data when re-ordering.

RSO table field list

Field Name	Size	Notes
RsoNumber	Char -25	
RSOStatus		RSO Status is a fixed list of options build into BRAHMS
RequestedBy	Char -128	Name of person requesting a plant
RequestSpecies	Char -255	Requested species (including infra names, cultivar, etc)
RequestVendor	Char -128	Preferred vendor
RequestMaterial	Char -50	Requested material e.g. seed, plants, cuttings
RequestItemNumber	Char -50	A catalogue number
RequestUnit	Char -50	Requested supplier product catalogue units, could be 'each', '2 litre pot', etc.
RequestUnitCost	Dec 8,2	Cost per unit
RequestUnitQuantity	Int	Number of units to order
CalcRequestItemTotalCost	Dec 8,2	Total cost of requested item
RequestedForDate	Date	Date material required to be ready/delivered
CalcRequestedForWeekNumber	Int	Week number of delivery
RequestedForGardenArea	Char -100	Material requested for where?
RequestedForGardenLocality	Char -100	Material requested for where?
RequestDeliveryContainer	Char -50	Requested delivery container
RequestDeliveryPlantsPerContainer	Int	Requested number of plants per container, typically 1
RequestDeliveryContainerQuantity	Int	Requested number of containers
CalcRequestDeliveryPlantsQuantity	Int	Calculated total plants (containers x plants per container)
RequestComments	Char -255	General comments for this request
IsAccessionMaterial	Bool	Is this material to be accessioned?
IsWildCollected	Bool	Is this material wild collected?
IsPropagationMaterial	Bool	Is the material to enter propagation?
RequestApprovedBy	Char -128	Request approved buy who
RequestApprovedOn	Date	Date of request approval
OrderItemNumber	Char -50	Actual ordered item number (catalogue number)
OrderUnit	Char -50	Product catalogue unit ordered
OrderUnitCost	Char -50	Cost per unit
OrderUnitQuantity	Dec 8,2	Amount ordered
CalcOrderItemTotalCost	Dec 8,2	Total cost
ScheduledOrderGroup	Int	A numeric field that may be used to help group orders
ScheduledOrderDate	Date	Scheduled date to order the item
OrderedBy	Char -128	Who ordered
OrderedOn	Date	Date of order
ReceivedBy	Char -128	Who received
ReceivedOn	Date	Date of Receipt
Comments	Char -max	Further general comments
IsArchived	Bool	Is the RSO record archived?

Production and Propagation

Introduction



Production and propagation data are stored in a single table which can be accessed and updated via the data grid or forms. As with all other tables, the fields displayed in the data grid are configurable. In this table, as there are many fields, using column selections may be especially important when working in the grids.

The BRAHMS production propagation components deal with accessioned and non-accessioned (seasonal) material. Accessioned material is assigned an accession number and maintained in the system with garden plant records added as and when appropriate. Non-accessioned (display/seasonal) material is managed via the Request, Scheduling, Ordering (RSO), Production/Propagation (PP) and dispatch stages. While non-accessioned records are maintained in the system, beyond dispatch to display, no further records are kept.

Prop-Prod records can have associated event records. These are similar to Plant event records. These events keep track of all actions for a given production or propagation line. Event lookups can be configured.

Many fields have separate values for Propagation and Production, for example, PropLocation and ProdLocation. A full list of fields is provided in this guide.

Propagation data primarily refer to the management of data for seed, cuttings and grafts. Each of these has a special set of fields and related form sections.

Requests for new plants made by curators, including their Scheduling and Ordering is managed by the RSO module. Although this is separate to the *Prop-Prod* module, there are links between RSO and production/propagation. These links are explained in the separate RSO manual section.

Trial numbers

The prop-prod table has a field called Trial Number. This field is used to indicate a sequence of propagation entries for the same Accession. For example, if material is propagated from seed, there may be several approaches used to see which method is the most successful. The trial number is auto incremented when adding new records. This field can be ignored if not required.

Plant Production

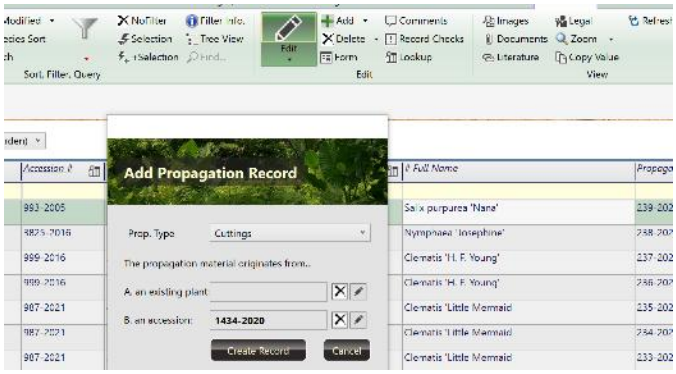
Introduction

Plant production deals with the growing on of plants from an initial stage until they are ready to be dispatched to the appropriate garden areas. For some species, the plant production period maybe relatively short. But for others, production may last for several years and involve several containers and/or location changes per plant. Plants in production are normally assessed and counted on a regular basis.

The plant production table and the associated form are opened by select **Collections > Production/Propagation**. This assumes your collection data category is set to *Living Collection*. As this table includes many fields also covering propagation, when using the data grid, it's important to set up and save one or more field views, using the standard tools to do so.

Adding new production/propagation records

For non-accessioned material, prop-prod records are added via the RSO module. For accessioned material, prop-prod records can be added via the RSO module or directly to the prop-prod table using the **Add** option. When adding a record directly, you must choose an Accession or Plant ID as prompted.



Adding a record directly to the prop-prod table for an existing Accession as type cuttings.

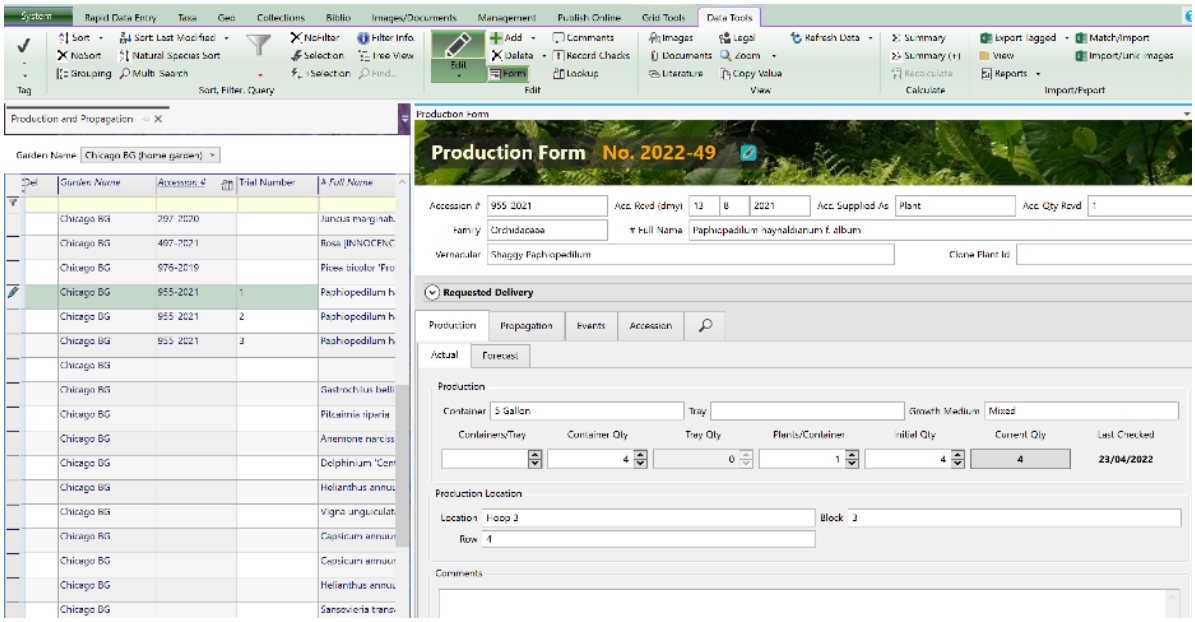
Requested plant delivery

A number of fields are associated with the plant production request. Aside from the actual species name itself, these include the requested delivery date/week number; delivery size/container size; the quantity of plants required; requested by and for who. These apply to both production and propagation.

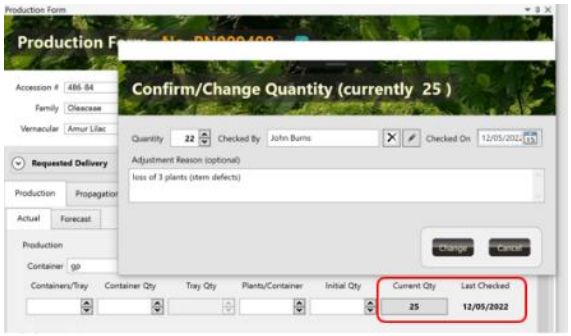
The Production Form

The main form provides a summary of Accession data (for accessioned material) in top section. Below this, the initial Request details are provided in a collapsible section. Below this are the main tabs for Production, Propagation, Events, Accession and Search.

Tab	Function
Production	Add/edit Actual and Forecasted plant Production details.
Propagation	Add/edit Actual and Forecasted plant Propagation details.
Events	Changes made to PP values are added as events.
Accession	Options related to accessioned material including listing plants.
Search	Locate records in the PP table.



Many of the fields on the production tab will have drop-down lookups. The location field headings are adjusted in your setup. Note that each project should populate their own lookup dictionaries.

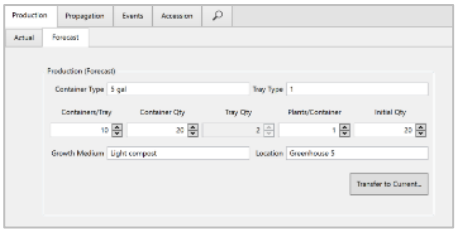


The 'Current Qty' option opens a small form to update the plant quantity and auto-adds the Last Checked date.

Actual vs Forecast fields

The production-propagation table includes a number of fields called *forecast fields*. During the plant scheduling and ordering phases, these fields are optionally added as part of the process of predicting and recommending the resources and conditions that will be likely be required to produce the requested plants. For example, for planning purposes, it is useful to know how much and what type of growing space and containers will be needed in advance. The forecast field values may be adjusted for planning purposes and are then copied to the *actual* production fields when the material enters production/propagation.

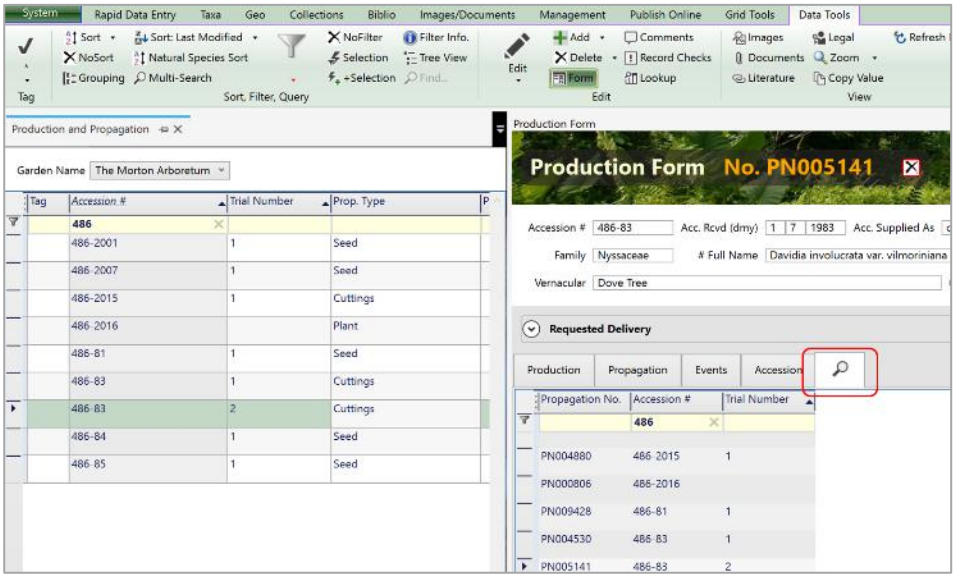
Production - Forecast tab



The forecast field values can be transferred to Current using the option provided.

Navigation and locating records

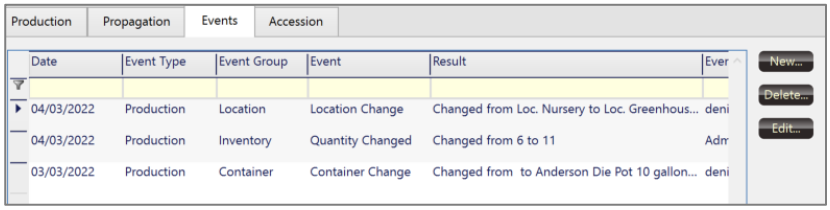
By selecting the navigation tab, you can filter to and locate records using the Propagation or Accession number. The 'trial number' can also be used.



The navigation tab allows you to locate PP records quickly. Filter selections on this tab are automatically reflected in the main data grid.

Events tab

Each production record can have one to many events added over time. These can be added manually but also, events are auto-added when the production stock, location, container or temperature changes are edited.

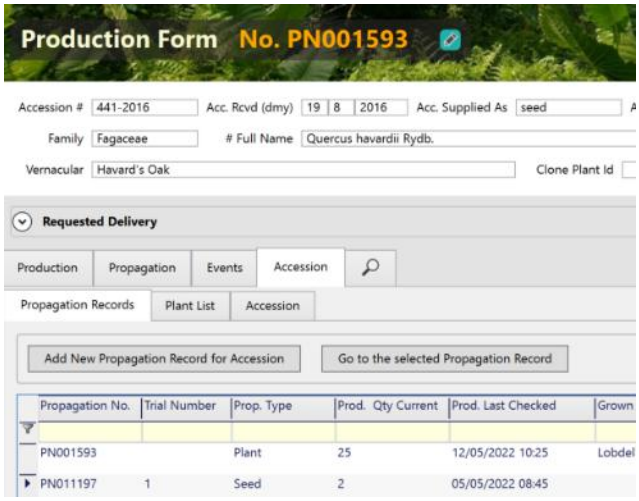


Plant production events are auto-added when form edits are made. They can also be manually added and edited.

Accession tab

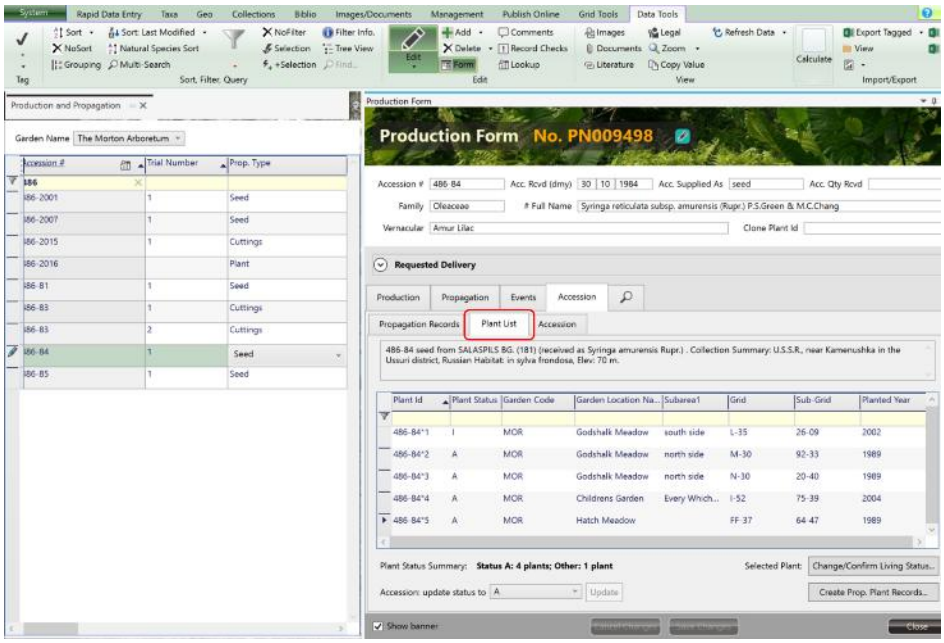
Propagation records tab

The Propagation records sub-tab lists all *Prop-Prod* records for the current accession



Plant List tab

The **Accession > Plant List** tab lists all plants for the current Accession – together with a selection of configurable fields.



Using the options on this tab, you can:

- **Edit the status of a selected plant record**. This may include a plant assigned to a Propagation area. Note that a summary of plants and their status is also provided.
- **Create a new production or propagation entry for the current accession**. This will auto- link the new PP record to the accession.
- **Change the Status of the Accession record itself**. For example, if all plants in production/propagation are dead – and there are no living plants for this accession elsewhere, the accession status can be set to dead/inactive (or as used in your setup).

Accession tab

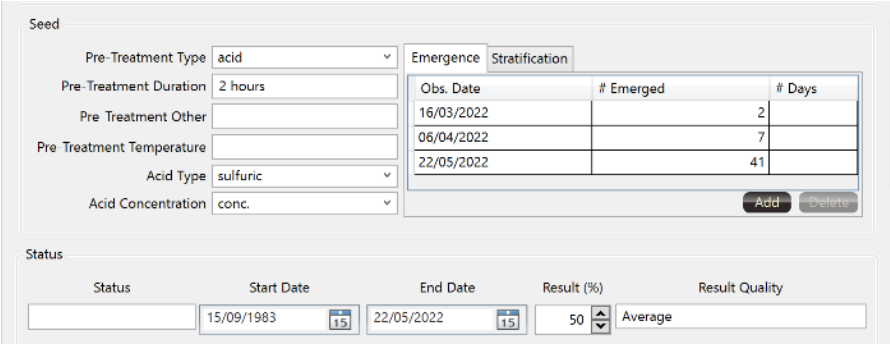
This provides a summary of the current accession record with an option to go to the record in the Accession table.

Plant Propagation

Introduction

New plant accessions (seed, bulbs, cuttings, living plants or another types of propagule) may be planted directly into a collection in the garden or kept in propagation to grow on before moving to a permanent garden site. Plant material, clonal or otherwise, may be collected from existing garden plants to further propagate.

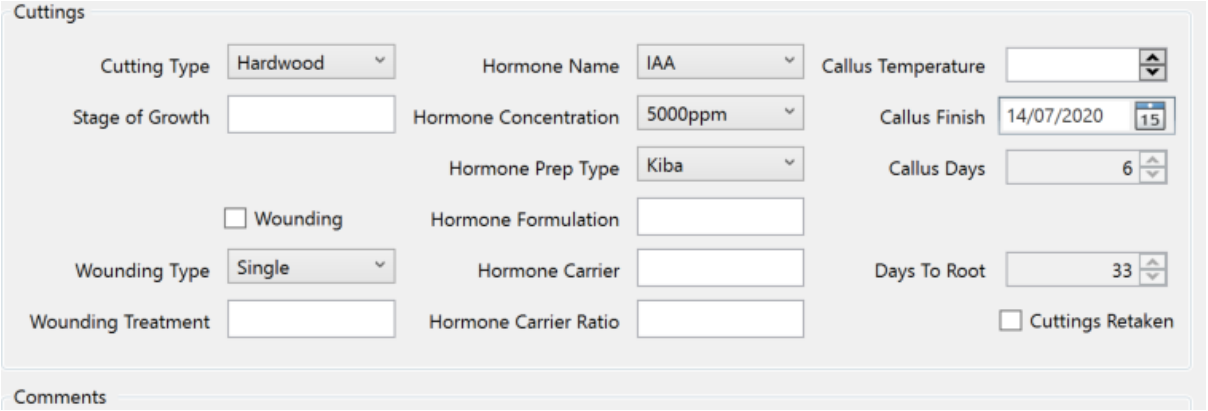
Seed propagation



For seed propagation, the form provides a way to keep track of how seed is processed and the germination/emergence success rates. The number of days between stratification treatments and the % germination success are auto-calculated.

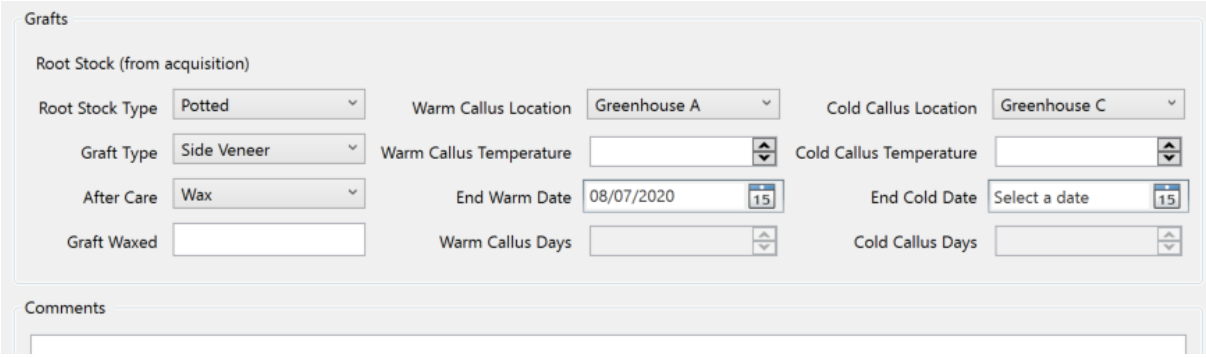
The result % calculation is the % of the emergent seeds compared to the initial quantity (=seed sown).

Cuttings propagation



Some of the fields provided for cuttings.

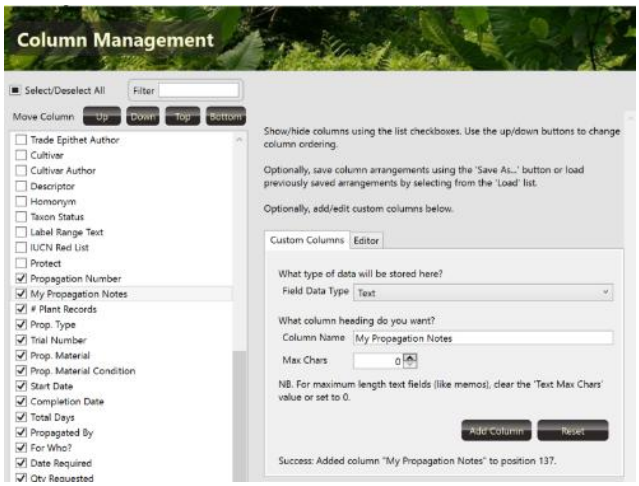
Graft propagation



Some of the fields provided for grafts.

Extending the propagation table structure

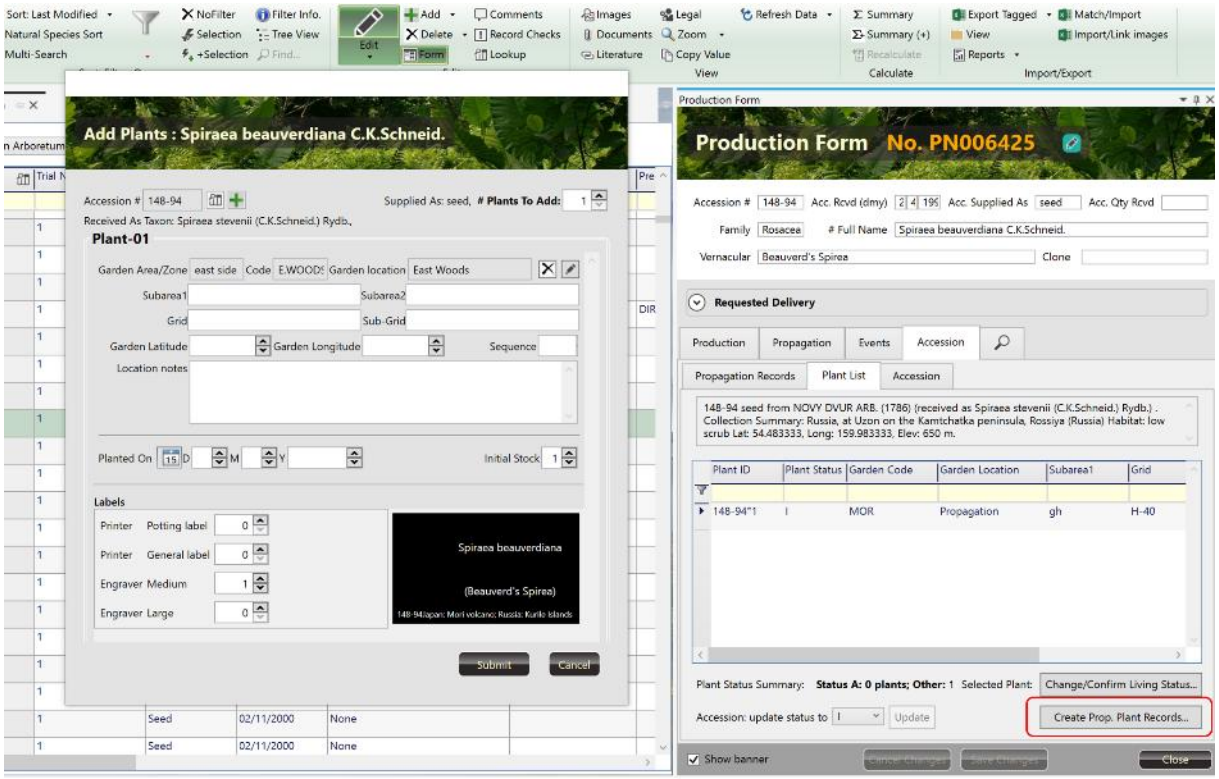
Using the **Grid Tools > Manage Columns > Custom Columns** option, you can extend the structure of the main propagation table, adding custom fields as needed.



A text field 'My Propagation Notes' has been added and positioned below the field Propagation Number.

Propagation to plants

From the propagation table form, when in **Edit** mode, you can **Add plants** to the garden. This function uses the standard plant addition form which allows you to choose the number of plants, their location(s) and label requirements. When plant records are added, the Propagation Number is added to the plant record(s) – providing a link from the plant back to its propagation origin.

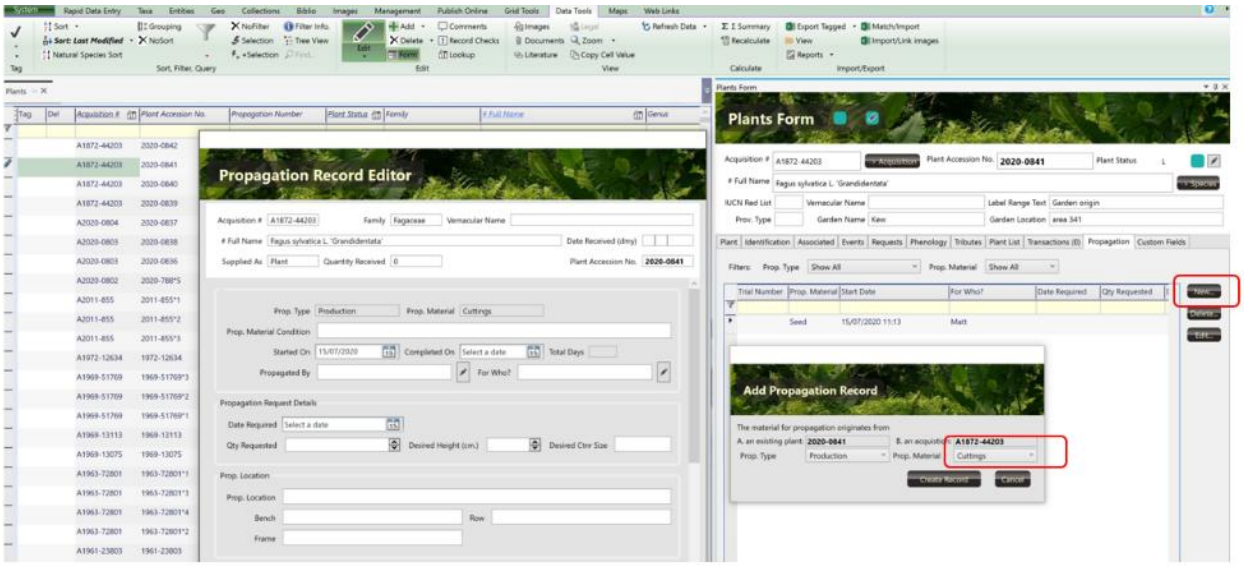


Generating new plant records directly from the propagation table. The Propagation Number is added to the main plants table, providing a link back to the origin propagation record.

Adding propagation records from the plant table

You can also add propagation records directly from the plant table. This would be used when gathering seed, cuttings or other material directly form plants in your garden. In Edit mode, select the **Propagation tab** on the plant form.

This option allows you to select the propagation material *e.g.* cuttings and then opens the main propagation form. The parent plant is added to the propagation record. Further propagation details can be added later by editing the propagation record in the prop table.



Adding a propagation record directly from the plants table.



The parent plant ID is added to the propagation table.

Events for Propagation and Production

Introduction

Propagation/Production (PP) records may also have events. These are similar to events for the main plant table in that each PP record may have 1 to many associated events. The events are organised in a 3 level hierarchy, as are plant events: Event Type, Event Group and Event.

Adding PP events

Certain PP events are auto-added when the PP records are edited. The auto-additions are for:

- Location and sublocation changes
- Container count change
- Growth medium change
- Day and Night temp change
- Treatment change

Events can also be added manually under any defined looks you may have.

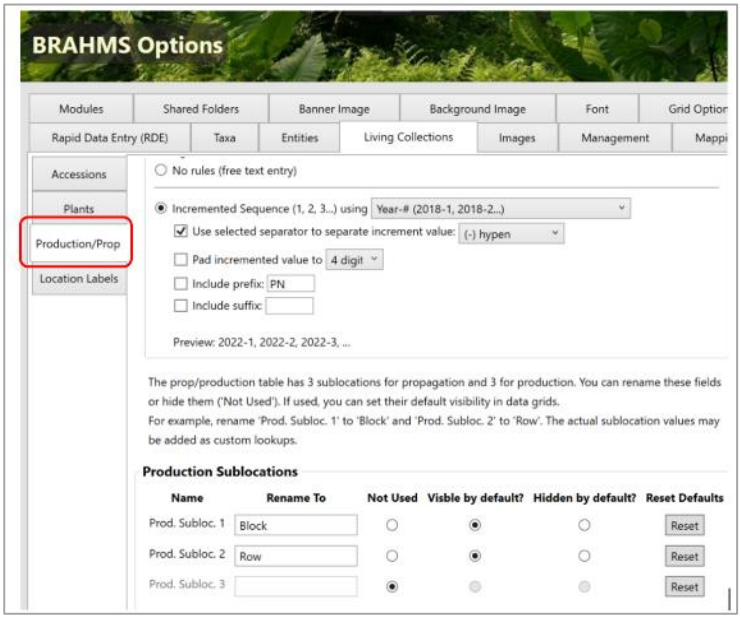
Defining lookups for PP events

The lookups for PP events are defined in a simpler way than for plant events. NB. In future revisions, all event lookups will be defined using this new method. Please refer to the section below on Event setup.

Setup options related to RSO and Production

Production-Propagation Numbering

Use **System > Options > Living Collections > Production/Prop.** to configure production/propagation numbering and sub-location headings.



Note that the sublocation values themselves can be added as custom lookups. In the above example, Block and Row are selected as headings – but as with garden locations, they may have many values.

Generating Lookup lists

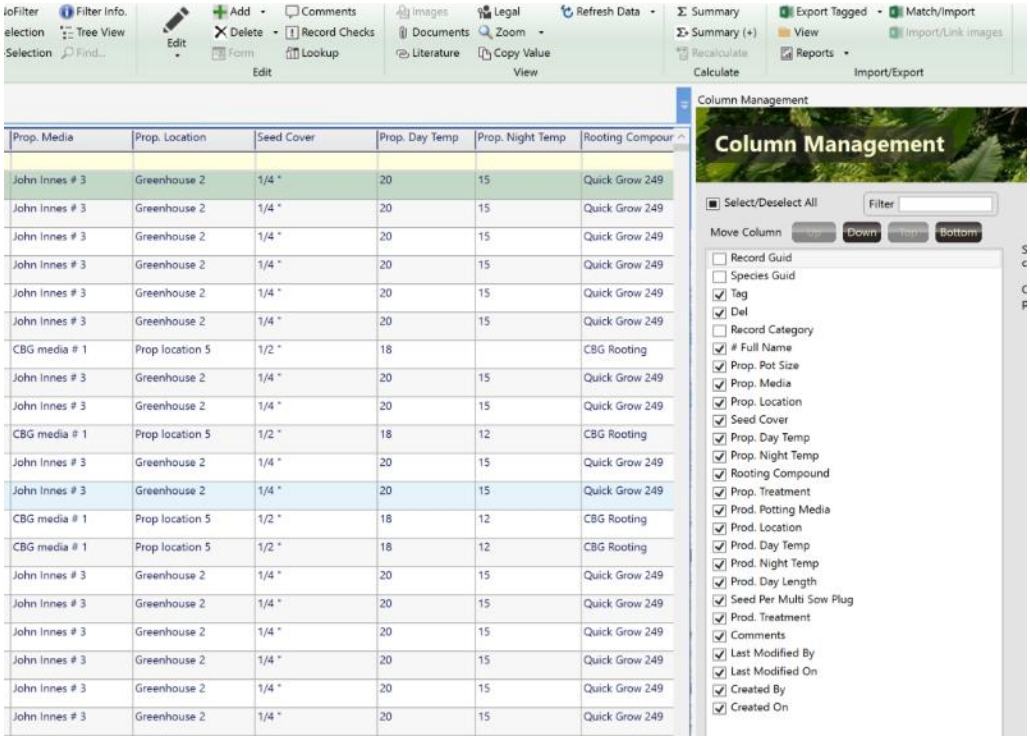
Many of the fields in the production/propagation table should be configured with lookup values. Lookup values standardise and greatly speed up data entry and editing and thus, it important these are added to your system.

Lookup values can be added manually or imported from Excel, both procedures are explained in the manual section on lookups. Note that when importing lookups from Excel, the field names themselves must be the same as the physical table fields and these are often different to the 'friendly' names used in the data grids and field lists options. A good way to get the correct name is to manually add a lookup value and check the Field Name value added to the lookup grid. A list of the correct field names is provided in the field list section.

Species defaults table

This table is opened on the **Taxa** menu with one record per entry in the main species table. The values stored here are the typical values expected for a given species. These data help to speed up and standardise data entry for plant requests and in particular, the data for their PropProd entries.

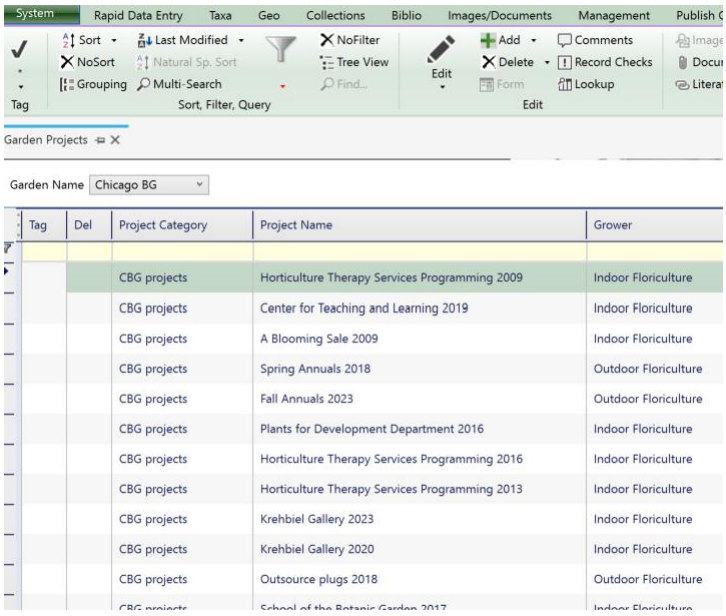
These data are pulled into the *Prop-Prod* table whenever an accepted RSO PP record is assigned a valid species. If data are edited in the species default table, the edited values would then be used when creating new RSO records but will not update values in existing RSO PP records.



The data in this example are entirely made up.

Garden Projects table

This table is opened from the main **Collections** menu when in living collections mode. It stores the names of garden projects. The function of this table is primarily for budgeting purposes so that when ordering new plants, they can be assigned to a 'project'. Garden projects can optionally be grouped into categories, and they are usually associated with a curator. They may also be associated with a garden location.

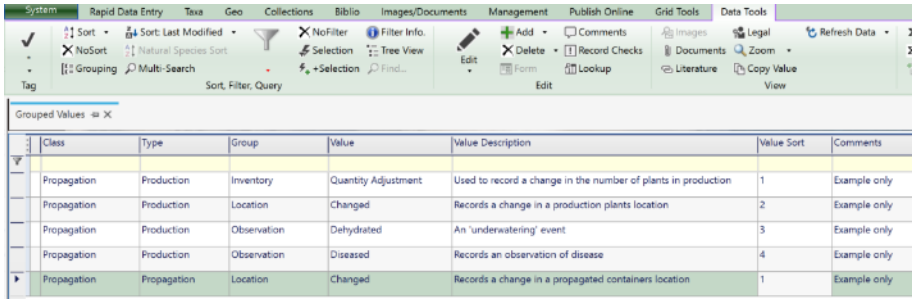


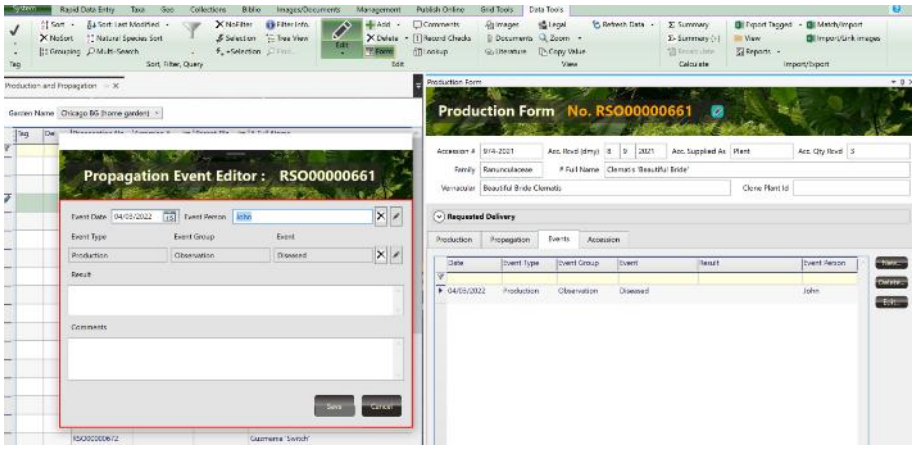
Tag	Del	Project Category	Project Name	Grower
		CBG projects	Horticulture Therapy Services Programming 2009	Indoor Floriculture
		CBG projects	Center for Teaching and Learning 2019	Indoor Floriculture
		CBG projects	A Blooming Sale 2009	Indoor Floriculture
		CBG projects	Spring Annuals 2018	Outdoor Floriculture
		CBG projects	Fall Annuals 2023	Outdoor Floriculture
		CBG projects	Plants for Development Department 2016	Indoor Floriculture
		CBG projects	Horticulture Therapy Services Programming 2016	Indoor Floriculture
		CBG projects	Horticulture Therapy Services Programming 2013	Indoor Floriculture
		CBG projects	Krehbiel Gallery 2023	Indoor Floriculture
		CBG projects	Krehbiel Gallery 2020	Indoor Floriculture
		CBG projects	Outsource plugs 2018	Outdoor Floriculture

Example garden projects as provide by Chicago Botanic Garden.

Production/Propagation Events

When adding plant production/propagation events, you can set up the lookups from **Management > Grouped Values**. These lookup values can be added in a 3 level hierarchy: Type, Group and Value.





Manually adding an event and selecting one of Event type/Event Group/Event the lookup values.

Production/Propagation field list

Field Name	Size	Notes
PropNumber	Char -25	Numbering system can be configured under Options > Setup.
PropMaterialType	Integer	None, Plant, Seed, Cuttings, Grafts, Culture, Division
PropMaterialCondition	Char -255	Condition of material entering propagation
RequestedDeliveryDate	Date	Material required for when – usually provided by curator
CalcRequestedForWeekNumber	Integer	Calculated from requested delivery date (ISO format)
RequestedDeliveryPlantHeight	Integer	Requested size of plant for delivery
RequestedDeliveryContainer	Char -50	Requested size of plant delivery container
RequestedDeliveryPlantsPerContainer	Integer	Number of plants per container when delivered
RequestedDeliveryContainerQuantity	Integer	Number of containers to deliver
CalcRequestedDeliveryPlantsQuantity	Integer	Calculated from above
GrowOrganically	Logical	Simple logical field – yes/no
PropagatedFor	Char -128	Name of curator the material is for
PropagatedBy	Char -128	Name of propagator
ScheduledStartDate	Char -20	A text field can be an actual date or e.g. 'about mid-May'
Propagation trials ONLY		
PropTrialNumber	Integer	Used only for accessioned material, the value is auto-incremented for a given accession with multiple propagation records
PropEndDate	date	Completion date, optionally added
PropTotalDays	Integer	Calculated from the start and end dates
PropResultPc	Integer	Calculated as per propagation category e.g. seed germination %
PropResultQuality	Char -50	Text description of result quality
Propagation forecast		Forecast fields are the best guess conditions when setting up e.g. to know how much space may be needed. These values can be maintained as entered but also transferred to Actual.
PropForecastLocation	Char -50	Location where material is expected to be propagated
PropForecastGrowthMedium	Char -50	Type of medium expected to be used
1 PropForecastTray	Char -50	Type of tray/flat
2 PropForecastContainer	Char -50	Type of container

3 PropForecastContainersPerTray	Integer	Number of containers per tray
4 PropForecastContainerQuantity	Integer	Number of containers
5 CalcPropForecastTrayQuantity	Integer	Calculated from the above 2 values
6 PropForecastQuantityPerContainer	Integer	Material quantity per container
7 PropForecastQuantityInitial	Integer	Initially calculated from number of containers x material quantity - but can be edited.
Propagation actual		
PropStatus	Char -10	User defined status codes - optional
PropStartDate	date	Actual propagation start date
PropBarcode	Char -20	Barcode for material
PropLocation	Char -50	Where material will be propagated
PropSublocation1	Char -30	Sublocation name headings can be configured
PropSublocation2	Char -30	Sublocation name headings can be configured
PropSublocation3	Char -30	Sublocation name headings can be configured
PropGrowthMedium	Char -50	Medium used
PropTray	Char -50	Type of tray (flat)
PropContainer	Char -50	Type of container
PropContainersPerTray	Integer	Number of containers per tray
PropContainerQuantity	Integer	Number of containers
CalcPropTrayQuantity	Integer	Calculated from the above 2 values
PropQuantityPerContainer	Integer	Material quantity per container
PropQuantityInitial	Integer	Initially calculated from number of containers x material quantity - but can be edited.
PropQuantityCurrent	Integer	Current quantity on periodic checking
PropDateLastChecked	date	Date of check
PropFailureReason	Char -255	Text describing failure
PropDayTemp	Integer	
PropNightTemp	Integer	
PropTreatment	Char -128	General text but can be more specific
PropSeedsPerPlug	Integer	
SeedCover	Char -15	
RootingCompound	Char -50	
Propagation GRAFTS ONLY		
WarmCallusTemperature	Char -15	
WarmCallusLocation	Char -50	
EndWarmCallusDate	date	
WarmCallusDays	Integer	
ColdCallusLocation	Char -50	
ColdCallusTemperature	Char -15	
EndColdCallusDate	date	
ColdCallusDays	Integer	
Aftercare	Char -50	
GraftType	Char -50	
GraftWaxed	Char -50	
RootStockType	Char -50	
Propagation CUTTINGS ONLY		
CallusFinish	date	
CallusTemperature	Integer	
CallusDays	Integer	
CutType	Char -25	
StageOfGrowth	Char -25	
DaysToRoot	Integer	
HormoneCarrier	Char -50	
HormoneCarrierRatio	Char -50	
HormoneConcentration	Char -10	
HormoneFormulation	Char -20	
HormoneName	Char -50	
HormonePrepType	Char -50	
Wounding	Logical	
WoundingTreatment	Char -20	
WoundingType	Char -20	
Retaken	Logical	
Propagation SEED ONLY		
PreTreatmentType		
AcidType	Char -30	
AcidConcentration	Char -30	
PreTreatmentTemperature	Char -15	
PreTreatmentDuration	Char -20	
PreTreatmentOther	Char -255	

PropQuantityInitialIsEstimated	Logical	
Production forecast		
ProdForecastLocation	Char -50	
ProdForecastTray	Char -50	
ProdForecastContainer	Char -50	
ProdForecastGrowthMedium	Char -50	
ProdForecastContainersPerTray	Integer	
ProdForecastPlantsPerContainer	Integer	
ProdForecastContainerQuantity	Integer	
CalcProdForecastTrayQuantity	Integer	
ProdForecastQuantityInitial	Integer	
Production actual		
ProdStatus	Char -10	User defined status codes - optional
ProdStartDate	date	Production start date
ProdBarcode	Char -20	Barcode for material
ProdSublocation1	Char -30	Sublocation name headings can be configured
ProdSublocation2	Char -30	Sublocation name headings can be configured
ProdSublocation3	Char -30	Sublocation name headings can be configured
ProdTray	Char -50	Type of tray (flat)
ProdContainer	Char -50	Type of container
ProdGrowthMedium	Char -50	Growth medium
ProdContainersPerTray	Integer	Number of containers per tray
ProdPlantsPerContainer	Integer	Plants per container
ProdContainerQuantity	Integer	Number of containers
CalcProdTrayQuantity	Integer	Calculated field
ProdQuantityInitial	Integer	Initial production quantity
ProdQuantityCurrent	Integer	Current quantity on check
ProdDateLastChecked	date	Date of last check
ProdFailureReason	Char -255	Text about failure
ProdDayTemp	Integer	
ProdNightTemp	Integer	
ProdDayLength	Char -50	
ProdTreatment	Char -128	

Mobile app for Botanic Gardens

All documentation for the BRAHMS garden app is found on this link:

https://herbaria.plants.ox.ac.uk/bol/content/software/v8/BRAHMSapp_guide.pdf

BRAHMS for Seed Banks and Seed Conservation Projects

Introduction

The seed module, developed collaboratively with the Millennium Seed Bank at RBG Kew, has broad curation and research applications for projects that collect, store, test and distribute seed. Seed accessions with passport and related source data, collection and/or seed accession permits, processing, weight/count calculations, viability/germination tests, storage and dispatch, related vouchers and images - are all fully integrated within BRAHMS. Data can be quickly imported via Rapid Data Entry (RDE) files which in turn can be populated with data from Excel. All standard BRAHMS functions for queries, reporting, image/document management, calculations and data analysis can be used.

The seed module aims to facilitate good seed management practice and to strengthen the ability of seed banks, small and large, to better coordinate their seed collection and distribution activities.

Key features

- Seed accession records including all passport and wild origin data can be managed with links to vouchers, project and legal agreement details, seed batch data, cleaning methodology and results, store bank location including duplication to other seed banks.
- Seed counting processes including absolute and/or estimates via seed sample weights, incorporation of x-ray and/or cut-testing analysis to provide adjusted quantities per collection.
- Germination test design including addition of multiple conditions and treatments. Germination test results are provided for both germination and viability percentages, including germination rate.
- PDF files, Excel sheets and other documents can be linked to accession, individual plant, species and other records. Examples are material transfer documents and species level spreadsheets.
- Images of seed or the plants in their original habitat can be added, together with voucher images as available.
- Projects can extend the standard BRAHMS seed data file structures by adding custom fields - these then become a part of your database.
- The Rapid Data Entry (RDE) module is used to capture new seed accessions and test data or to transfer data from other formats such as Excel worksheets.
- Easy to export data to other formats such as Excel - for further processing.
- You can design your own website and publish a virtual seedbank or online plant catalogue directly from BRAHMS sing BRAHMS WebConnect. For example see the RBG Kew MSBP Data Warehouse at http://brahmsonline.kew.org/msbp.

Taxa	An infrastructure of taxa from higher classification to infra-specific levels, cultivars and hybrids. Storing all specific epithets, synonymy, common names, descriptions, native distribution, hardiness, shade tolerance, water requirements, conservation status and further details.
Institutions	Comprehensive lists of institutions and addresses of suppliers and donors or those receiving material through purchase or transaction exchanges.
Seed Accessions	Storage of seed 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.
Agreements/ Permits	The ability to link agreement documents and set restrictions with a legal framework as required for collection events, seed accession and any other relevant records.
Seed cleaning	Adding all cleaning steps with associated times and notes.

Seed tests	Seed germination tests with their calculations and results.
Seed Duplication	A list of institutions where a seed accession is known to be duplicated.
Processing	Seed cleaning records together with their cleaning steps.
Seed Storage	Details on seed accession storage with quantities and locations/sublocations.
Transactions	The management of incoming seed batches and any outgoing transactions.
Collection Events	Details about what was collected when, where and by who. Collection events are used to record the seed collection site and its details.
Vouchers	Vouchers and related materials can be stored for seed accessions wild collections and/or established garden plants.
Images and Documents	Images and documents associated with Accessions, Plants, Vouchers, Transactions, *etc.* These can be physical files or media library URLs.
Legal/Permits	Details of all permits and related documentation for the accession, use and exchange of material, evidence of due diligence and restriction requirements.

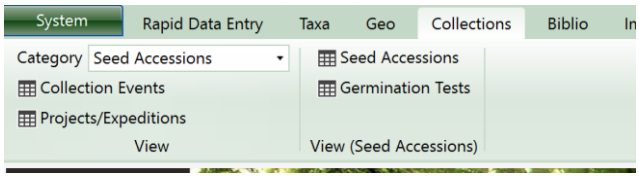
Summary of the key components used in the seed module.

Setup options - lookups

Before using the seed module, we recommend you check that you have the appropriate lookups as the seed module table have many fields that benefit from these. Examples are material collected, seed cleaning steps, tetrazolium staining results, seed test stages and treatments. You can enter lookups manually or import from Excel, Refer to the manual section on lookups. A sample lookup Excel table is provided on: https://herbaria.plants.ox.ac.uk/bol/content/Software/v8/seedmodulelookups.zip

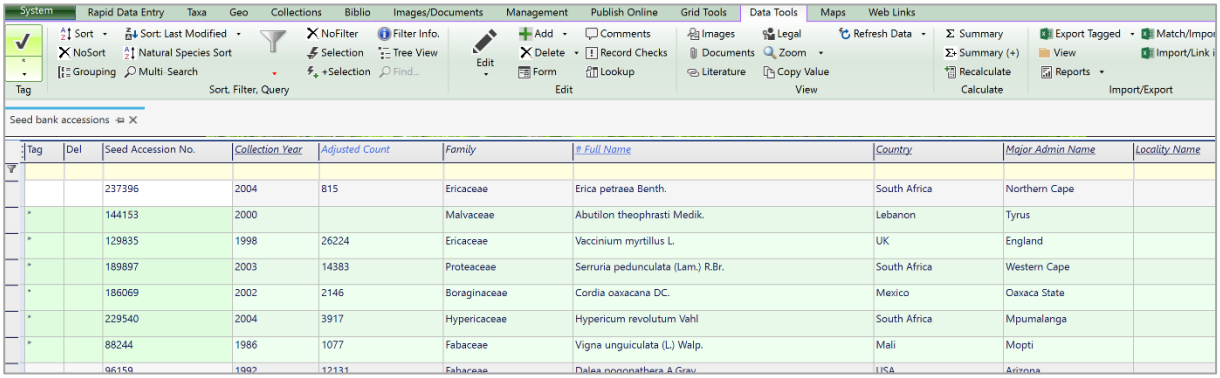
Seed accessions – overview

Introduction



The main seed accessions table is opened by selecting **Seed Accessions** on the main Collections menu when the **Collection Category** is set to *Seed Accessions*.

Once opened, you can make use of all the standard toolbar options to select visible columns, sort, query and summarise your seed accession data.



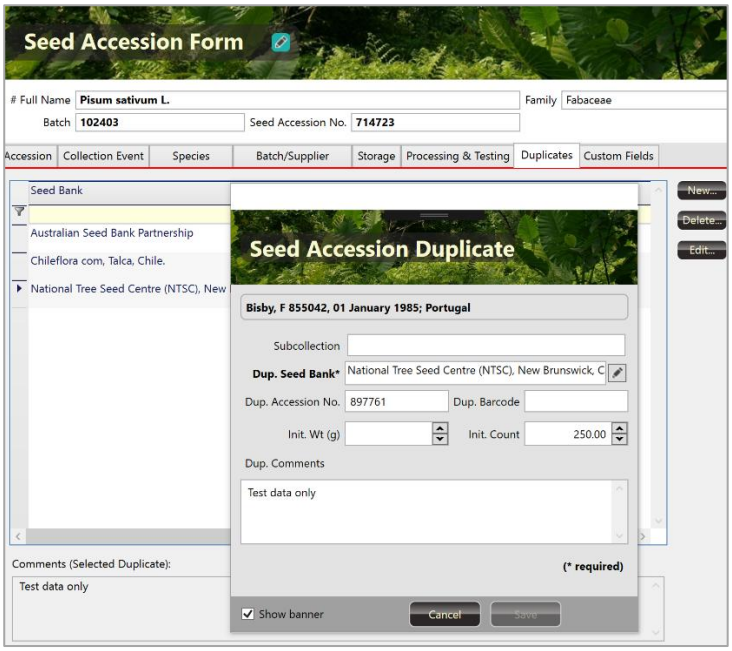
The main Seed Accessions table opened with a selection of the available fields set to visible.

Accession numbering and store bank

Accession numbering is currently free text entry although automatic numbering options are likely to be added. Projects may only be storing seed for their own seed bank. However it is also possible to collate data records from multiple banks. For this reason, the Store Bank is available as a field in seed accession records.

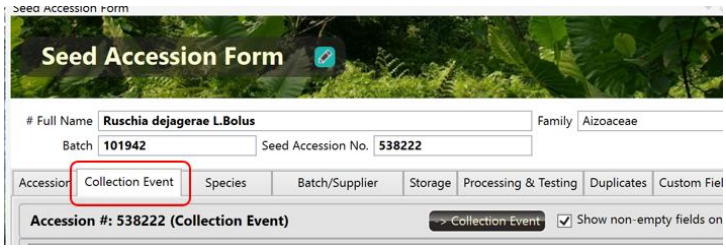
Seed Bank and Seed Duplication

It is possible to record the physical duplication of a seed collection to one or more seed banks using the **Duplicates** option. This option allows you



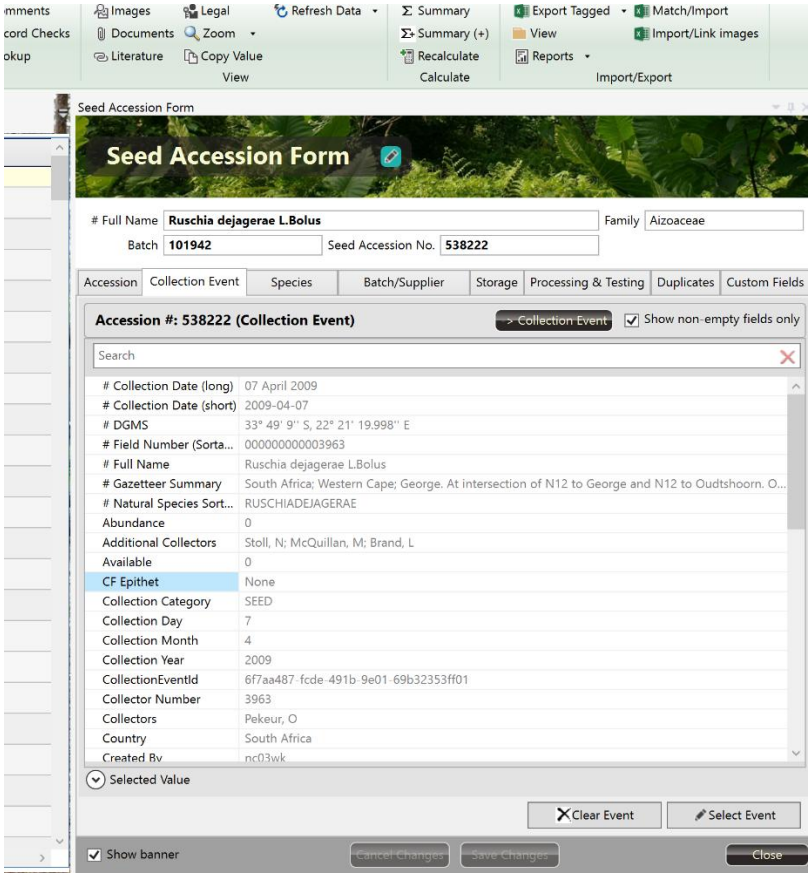
Source/wild origin details

These data describe the source of the seed collection including the location, date, collector(s), initial identification and other site details as required. The data are stored in a linked Collection Event record and can thus take advantage of all the possible collection storage fields – including any custom fields.



The Collection Event tab on the main seed form.

Collection events may also have linked voucher material stored as specimens. You can add, edit and view linked Collection Events details from the seed accession form. Collection events details can also be added *via* RDE imports.



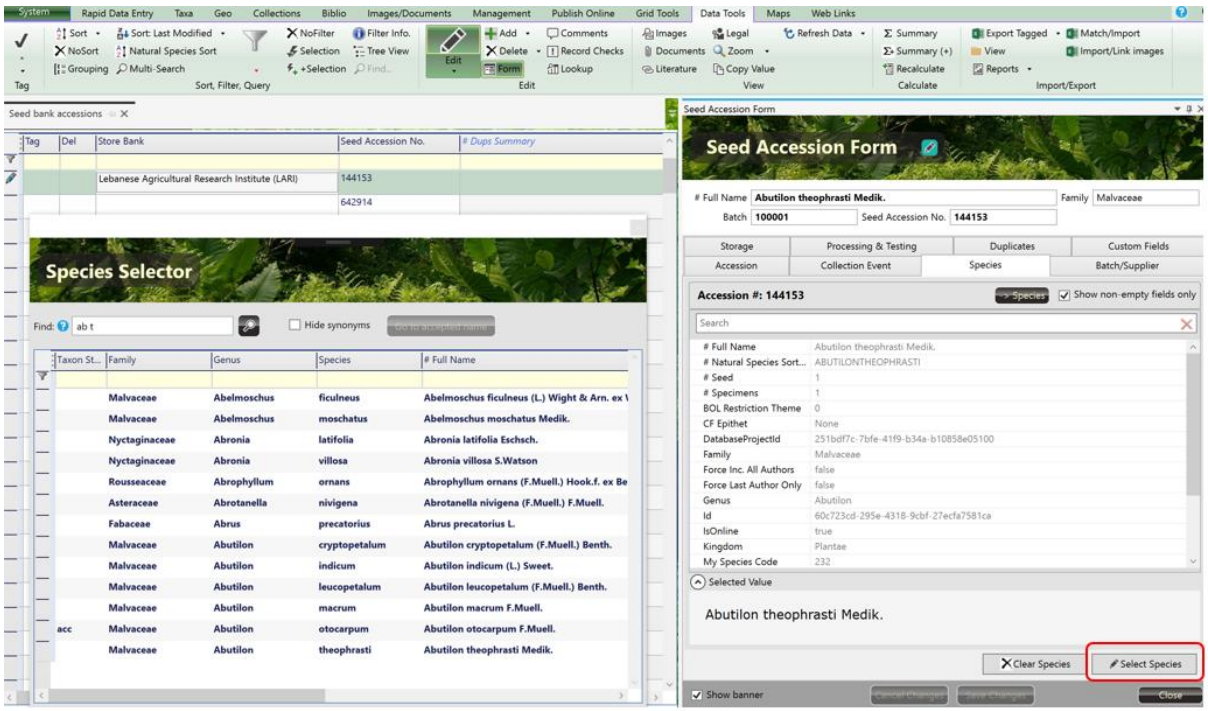
*A summary of the current event is provided on this tab. The **-> Collection Event** option opens the collection event table and locates the relevant record. To add a new event and/or to select an existing event, use **Select Event**.*

Batch numbers, supplier details and transactions

Seed supplier details including supplier name and receipt date are now stored in a transaction record. Thus, if you have a batch of incoming seed accessions, these can all be linked to one transaction record. This area of the guide to be expanded.

Seed identification and species data

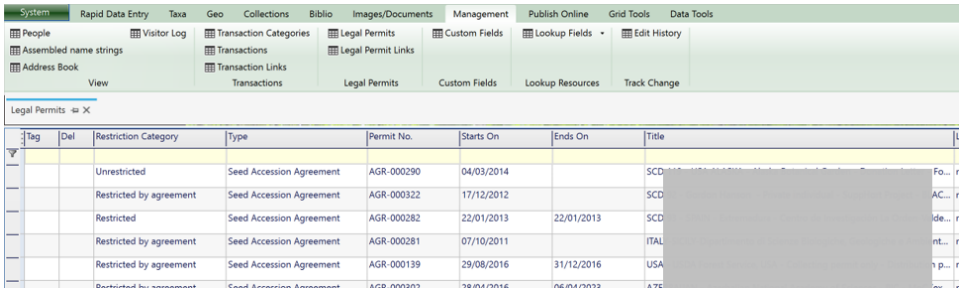
You can edit the identification of a seed accession from the data grid or the seed form. From the grid, use a standard lookup in any species related field. The **Species** tab on the seed form can also be used. The form has additional options to display a summary of the current species and an option to locate the current species in the main species table.



Legal permits/agreements

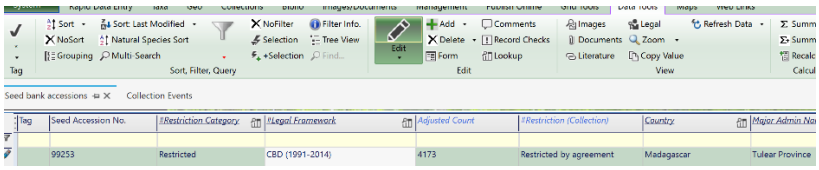
You can associate your seed accessions with permits or a selected category and assign a distribution restriction status, optionally with a legal framework.

Your documented agreements/legal permits can be registered in the **Legal Permits** table which is opened on the main **Management** menu. Here you add titles, agreement start and end dates, restriction status, *etc.*



Legal permit table example entries.

You can link multiple agreements or the same or different categories to a single seed accession record. In the seed accession record itself, you can display the restriction status assigned both to the seed accession and its related collection event.



In the above example, the seed accession has Restricted status. The linked collection event has a 'Restricted by agreement' status. This status will apply to the original collection permit.

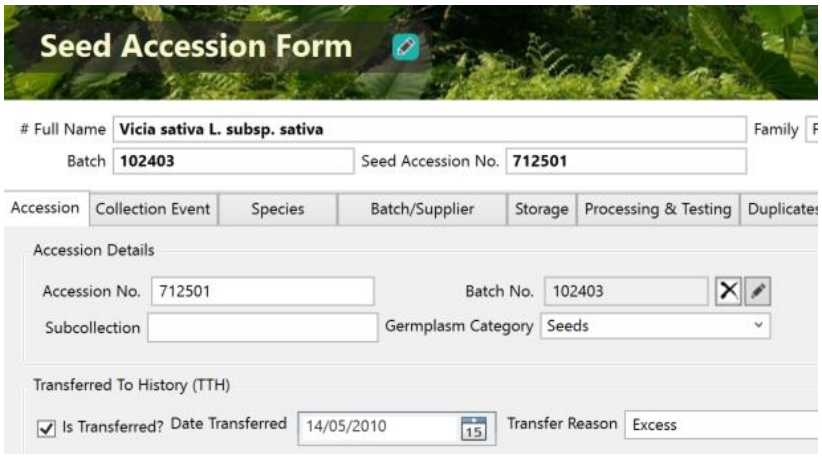
For further details of permits, refer to the Legal permits and permissions section.

Calculated fields

As with other tables in BRAHMS, the seed accession table has a number of calculated fields. These can be periodically updated using the Recalculate toolbar option. Examples are #Dups Summary, #Test Total, # Last Test Date and #Best Ever Test %.

Transfer to History (TTH)

Use the TTH fields to effectively archive seed accessions. Reasons may be seed failed to pass a retest, seed disease, seed damaged, etc…



Adding custom fields

If BRAHMS does not include a data storage field that you need, you can add to your database, choosing the data type and field name. For example, you may want to add a new field to your Seed Accessions table called 'My Seed Notes'. The use of custom fields is discussed in the section Adding Custom Fields.

Adding seed accessions

You can add records one by one using the standard **Add** option on the Data Tools toolbar. Alternatively, you can use Rapid Data Entry (RDE) to batch load records. When using the RDE approach, you can also import data from Excel spreadsheets.

Manual entry

To add an individual seed accession record, use **Add** to add records individually. You can in fact use the Add drop-down to add multiple blank records to the seed table.



The task then is to enter the details for the new record. In most cases, it will be easier to the **seed form**. When adding or editing data in Edit mode, you can use lookups for many fields including all those fields where you have registered lookups.

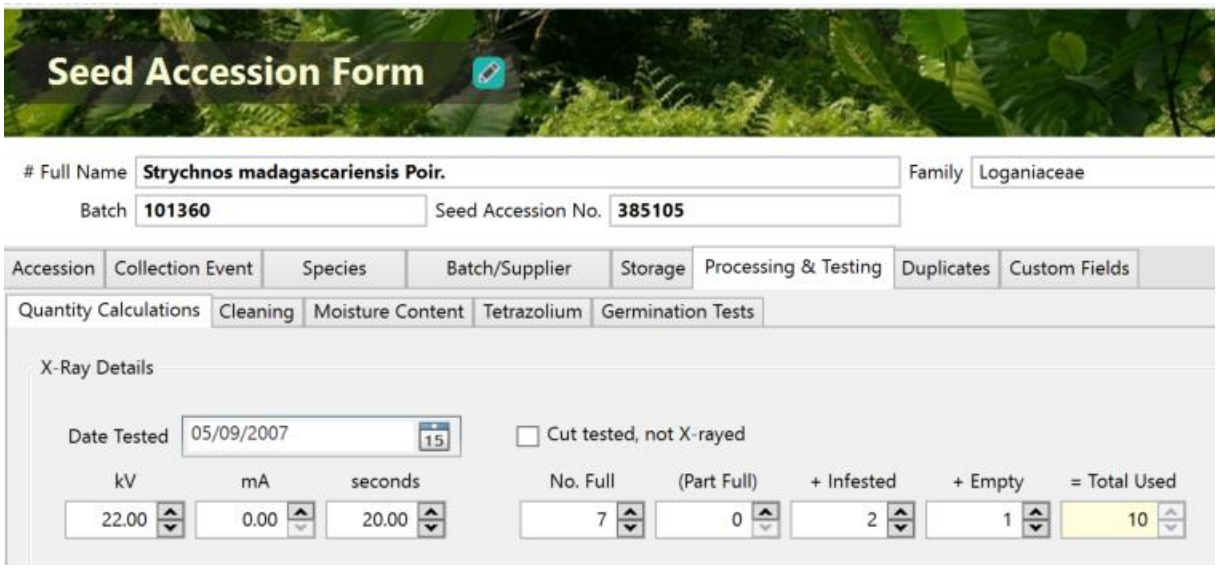
Using Rapid Data Entry/Excel

The use of RDE is discussed in the manual section on Rapid Data Entry.

Processing and testing

X-Ray data

X-Ray details are added from the **Seed Accession** form **Quantity Calculations** tab. The count fields for Full, Part Full, Infested and Empty are enabled. The Total is a calculated value. These data are used to calculate the Adjusted Quantity as disucssed below. If using a Cut Test, the X-Ray fields are disabled.



Seed weights and counts

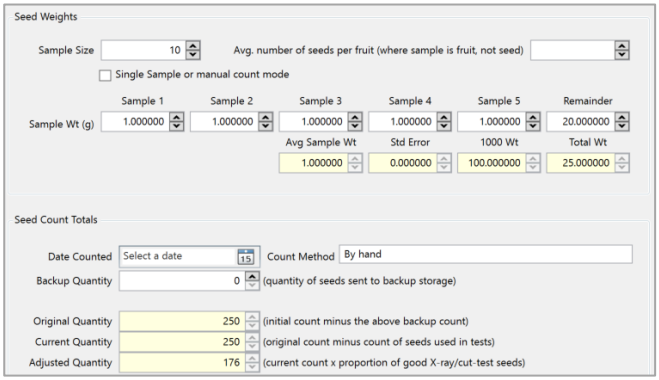
Seed counts are calculated from the **Seed Accession** form **Quantity Calculations** tab.

The seed accession table has 3 calculated seed count fields: initial Count, Current Count and Adjusted Account. These values are calculated by entering the appropriate data on the **Quantity Calculations** tab.

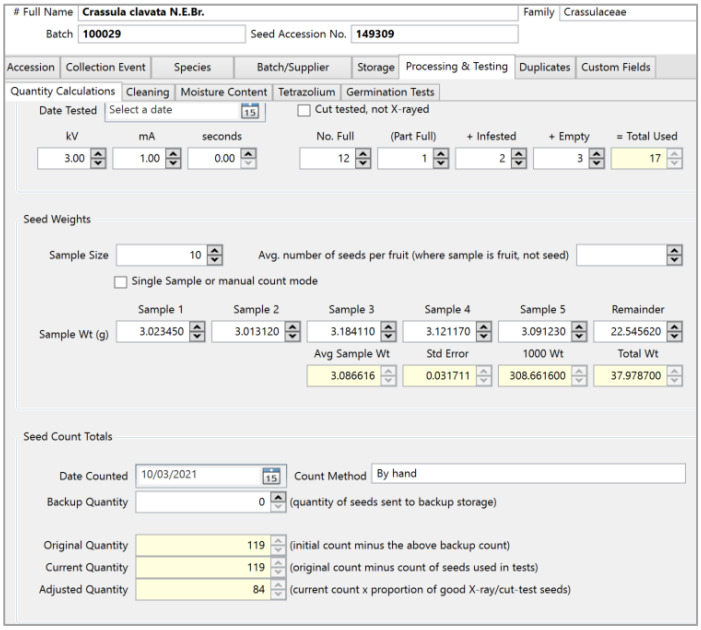
The first step is to add the Sample Size and the Seed Weights. Weights will be added either as a single weight sample or as 5 replicate weight samples. In either case, the Remainder weight is added.

Another consideration is whether these counts refer to seeds (the default) or to the *Average number of seed per fruit*. If using the fruits method (by adding a number to this field), the calculations are adjusted accordingly.

When the weight values are added, the Quantity calculations are updated automatically – as are the Average weight, Standard Error, TPSW and Total weight.



In the above example, there are 5 weight samples of 10 seeds each, each weighing exactly 1 g amounting thus to 50 seeds and 5 g in total. There is a remaining weight of 20 g.



In the above example,

Moisture content

Introduction

Reliable monitoring of seed moisture status is important in the handling and processing of seed collections. To learn more about moisture content measurements, refer to the Kew MSB guide on Measuring seed moisture status using a hygrometer.

Adding and editing moisture content records

You can add moisture content test results using the **Processing &Testing > Moisture Content tab** on the main seed accession form.

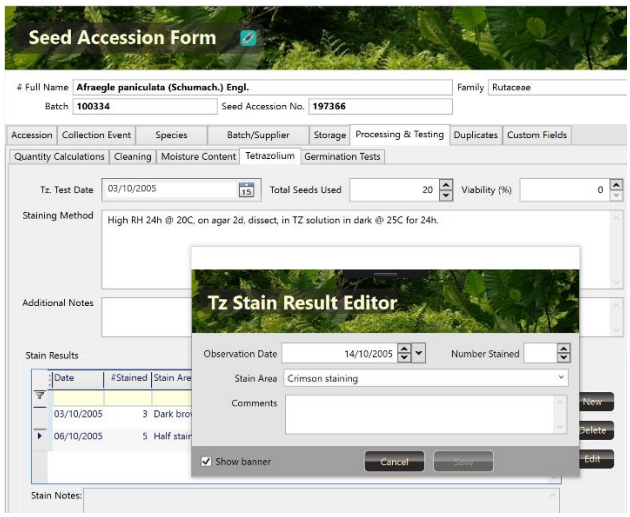
Tetrazolium testing

Introduction

The Tetrazolium test measures potential germination – it provides a quick estimate of seed viability. With results within one to two days this test can be very helpful when time is a factor or for species which have very long germination requirements. For further information on Tetrazolium Testing, refer to the Seed Check technologies fact sheet.

Adding and editing Tetrazolium Test data

You can add tz test results using the **Processing &Testing > Tetrazolium tab** on the main seed accession form. A list of staining areas would normally be added to your custom lookup list.



Adding a Tetrazolium test staining result.

Germination tests

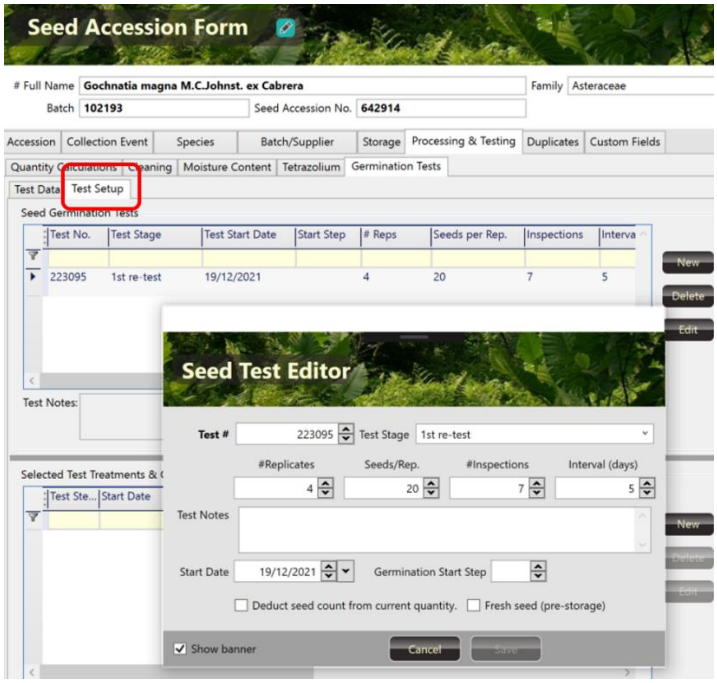
Introduction

Different seed banks have their own procedures for monitoring seed viability. This section explains how germination test procedures are managed within BRAHMS. These procedures are those used by the Kew Millennium Seed Bank (MSB) and it is with their input that these procedures have been developed.

Germination tests are normally carried out to monitor the viability of seed collections and to develop protocols for turning seeds into plants. Germination testing is often the most reliable way of assessing viability. For a detailed review of germination testing, refer to the Millennium Seed Bank document on Germination testing – procedures and evaluation.

Test set-up – adding a new test

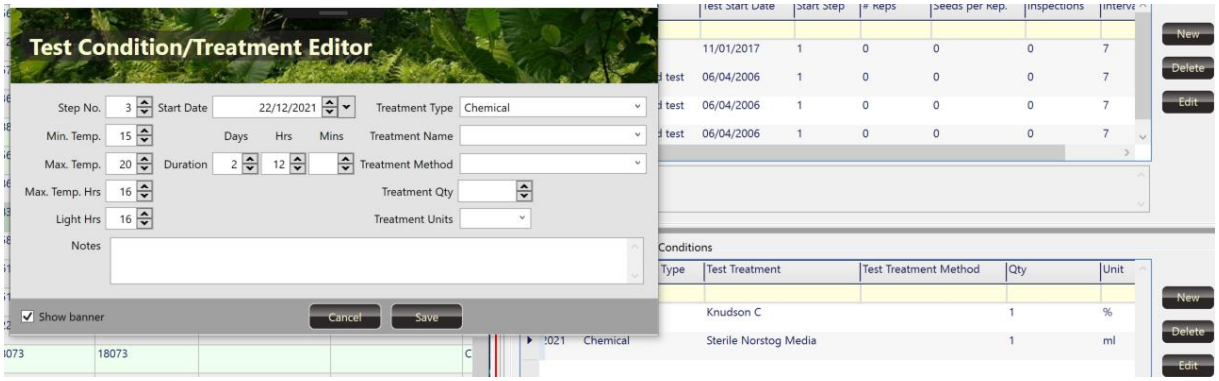
New tests are added from the Seed Accession form tab **Processing & Testing > Germination tests > test Setup**. New seed tests are assigned a numeric ID by BRAHMS. At this stage, you are asked to enter the # replicates, the # seeds per replicate, the total number of predicted inspections and the inspection interval in days. When you add a test setup, the system prepares the test scoring table for you, as described in the next step.



Add a new seed test setup.

Test set-up – conditions and dormancy-breaking treatments

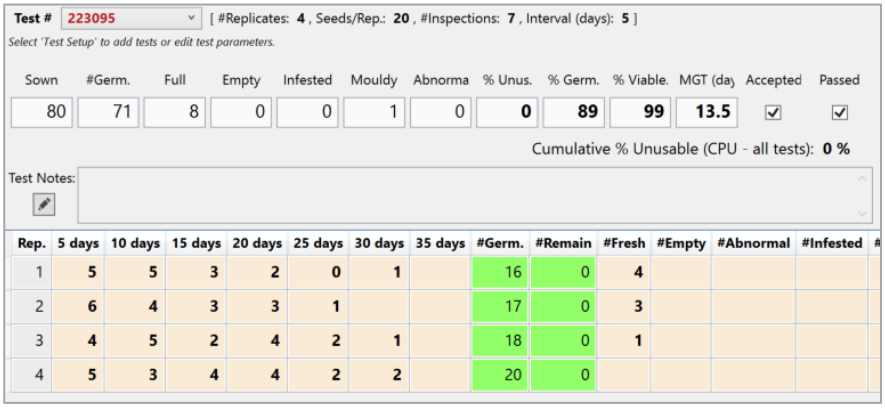
Each test can have 1:many condition/treatment records added. For an explanation of these, refer to the Millennium Seed Bank document on [Germination testing: environmental factors and dormancy-breaking treatments](#).



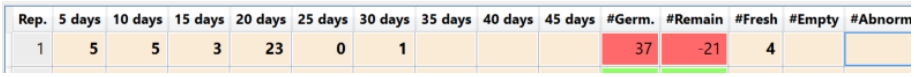
Adding conditions and treatments for a seed test.

Scoring germination test results and calculations

To enter or edit data for a test, switch to the **Test Data** tab. Here you can enter the test data from the designated number of reps and inspections. If you need to extend the inspection days, return to edit the test setup.



As test results are entered, a colour warnings are given where totals are erroneous.



The above 20 seed replicate has in incorrect entry.

The calculated results are displayed above the grid. The results include

Sown, # Germ, Full, Empty, Infested, Mouldy, Abnormal, % Unused, % Germ, % Viable and MGT (Mean Time to Germination).

The test can be Accepted and Passed.

Seed Test data grid

All seed tests stored in your database can be viewed from the main **Collections > Germination Tests** data grid. Here you can sort, filter and analysis all tests across accessions and taxa.

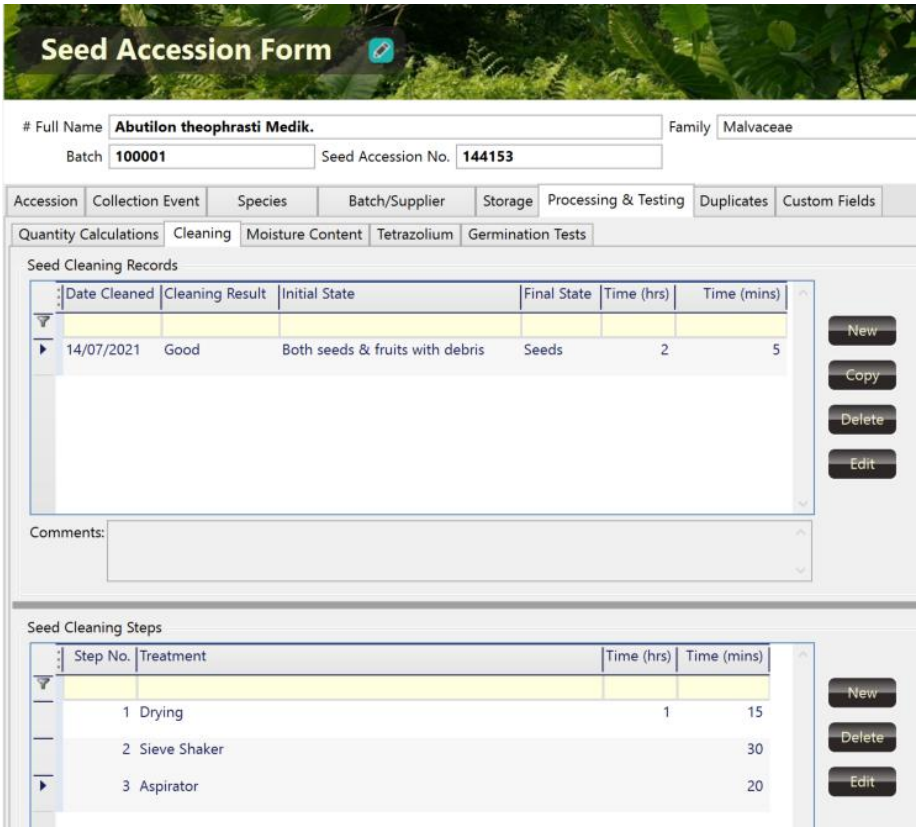
Seed cleaning

Introduction

Seeds are cleaned to decrease bulk, reduce disease risk, and facilitate future use. Cleaning long-term conservation collections without causing physical damage and reducing seed viability requires care and expertise. To read more about seed cleaning refer to the Kew MSB guide on Cleaning seed collections for long-term conservation.

Adding and editing seed cleaning records

Each seed accession may have one or more cleaning records added. Each cleaning entry records the initial and final state of the seed as well as the 1: many steps per cleaning record. The time of individual steps is recorded and totalled up in the cleaning record.



Lookup values for fields such as Initial State can be stored as custom lookups to standardise and speed up data capture.

Seed storage and distribution

Section to be added.

Linking images and documents

You can link any number of images and or documents directly to seed accession records, tests, collection events, species and any other record related to your seed accessions. For further details, refer to the relevant sections in this guide on image linking and document linking.

Generating reports and exporting data

You can design report templates for seed accessions and all related records including seed transactions. Full details of report design are covered in the reports section of this guide.

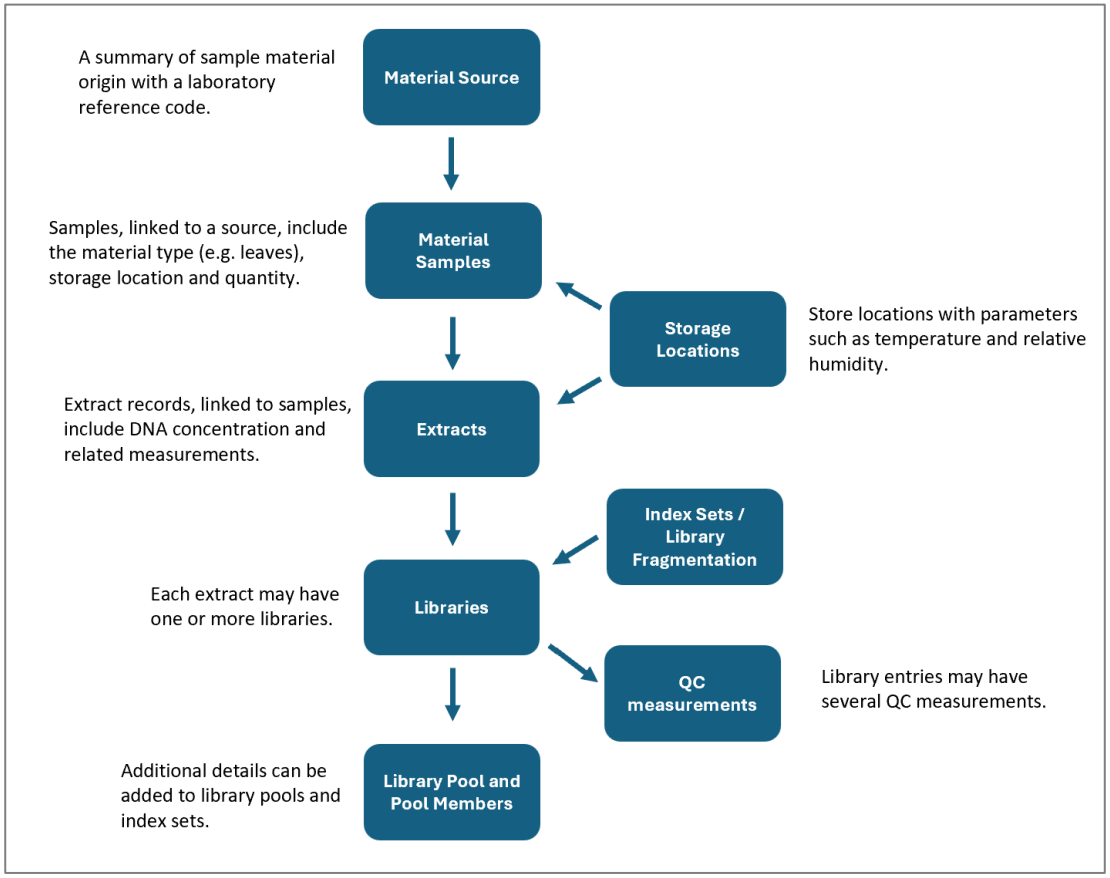
All data export options including transfers to Excel, XML and Darwin Core are covered in the exporting data section of this guide.

DNA and Tissue Samples Module



Introduction

The DNA and laboratories module provides a mechanism to document and organise data that describe material samples and their origin, their DNA extracts and related library data. These data can be integrated with other data in BRAHMS, for example, linking to a unified species list, associating your samples with garden plants, herbarium specimens or seed accessions. Samples and extracts are linked to a central list of sample storage locations with location properties. The main tables in the DNA module are displayed in the diagram below. Custom fields can be added to these tables as needed.

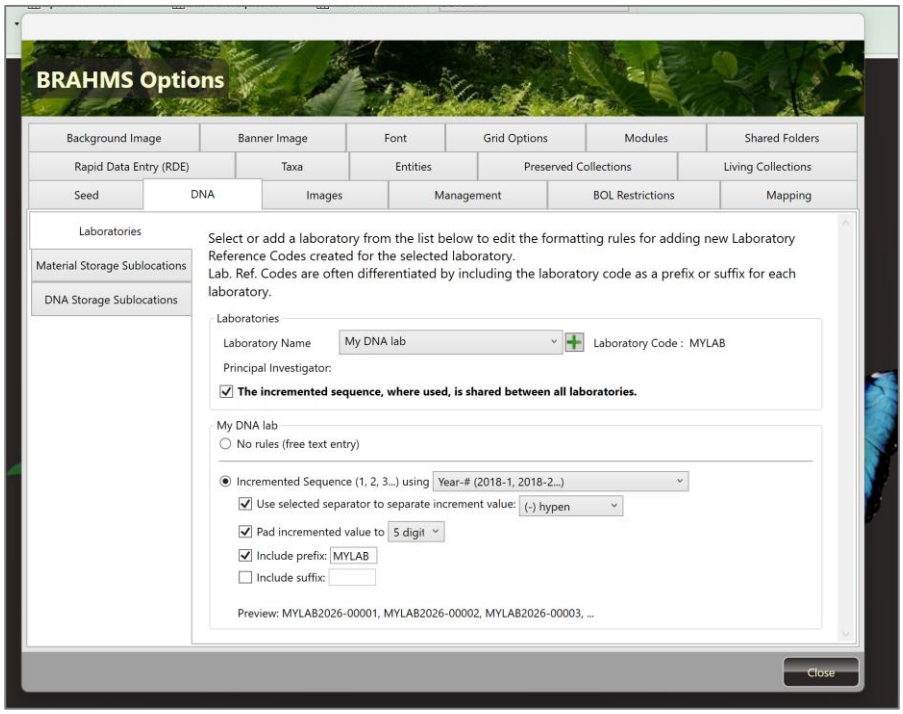


Tissue Samples and DNA module table layout

Setup options

Lab reference numbering

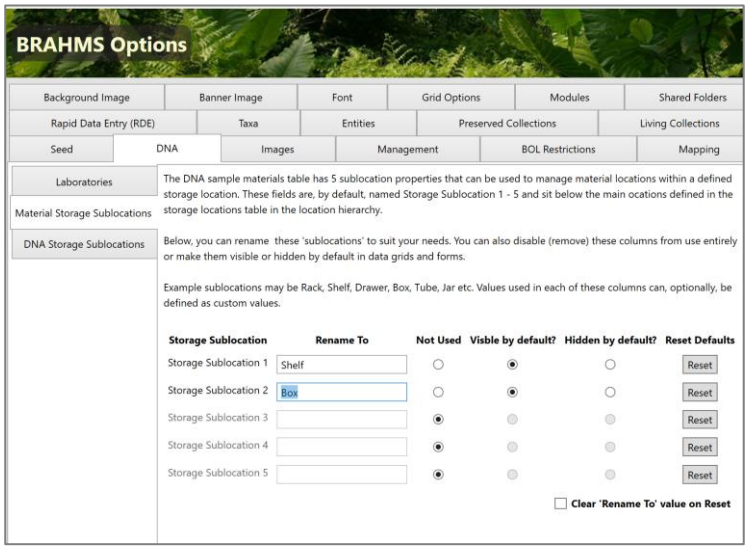
Each lab has its own preferred numbering system for its samples. An automated numbering format can be selected here. If 'No Rules' is selected, numbers are manually added.



The set up options include the ability to choose automated lab reference sample numbering.

Material Storage sublocations

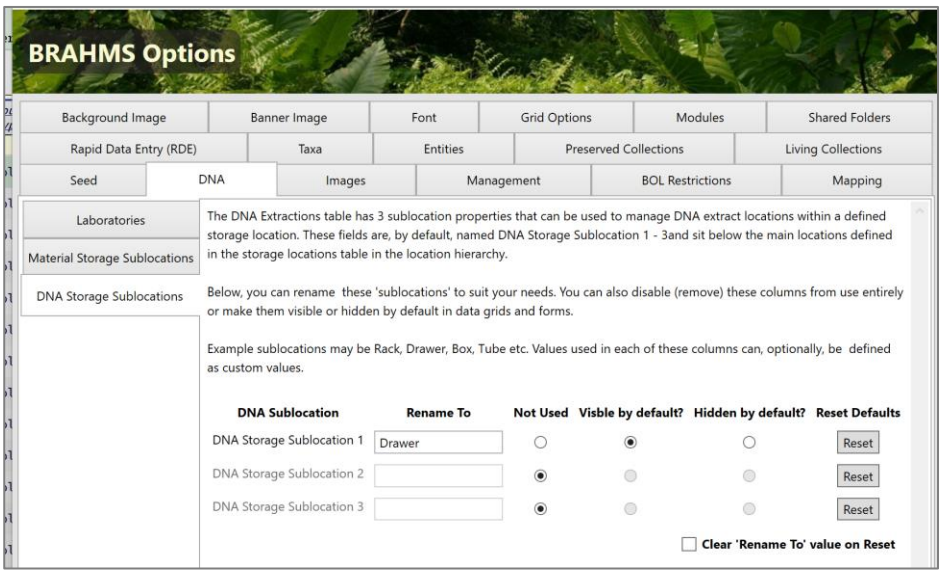
In addition to the main storage location as taken from the **DNA > Storage Locations** table, you can assign up to 5 sample sublocation areas with headings such as Box, Shelf and Container. Unused options are not displayed in the data grid or on forms. None are forcibly required.



Optional sample store sublocation names can be assigned. If assigned, they appear in the relevant grids and forms.

Extract Storage sublocations

In addition to the main storage location as taken from the **DNA > Storage Locations** table, you can assign up to 3 extract sublocation areas with headings such as Box and Freezer. Unused options are not displayed in the data grid or on forms. None are required.

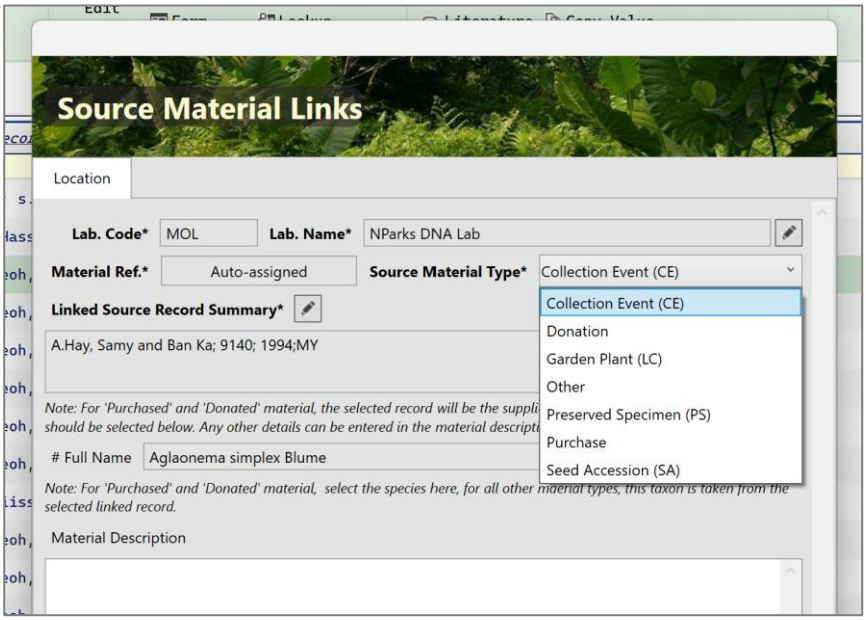


Optional extract storage sublocation headings can be assigned here. If assigned, they will appear in the relevant data grids and forms.

Material Sources

Introduction

The material sources table opened using **DNA > Material Sources** provides a summary table showing your sample sources. Material may have been collected from one of several sources as listed in the screen below. The lookup option allows you to select a record of the relevant type, for example a collection event or garden plant. The purpose of this table is to provide a central source listing how all of your sample material were collected.

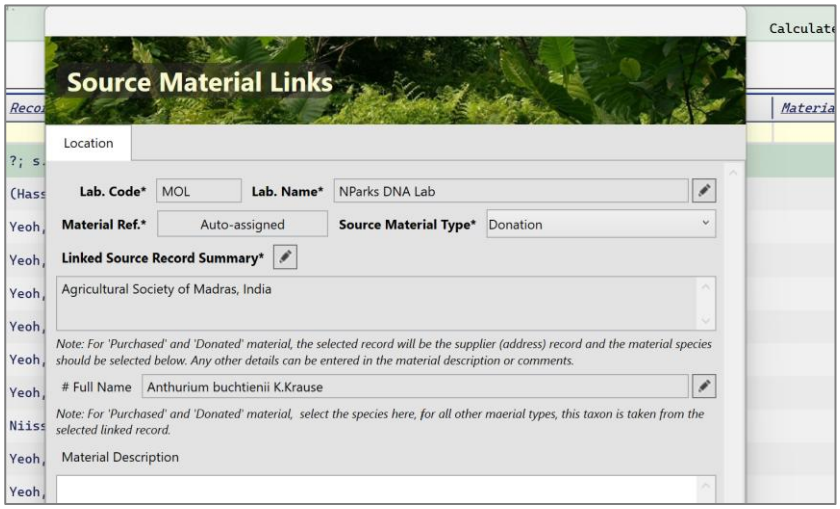


The Material Sources table provides a summary of the sample origin and is where the lab reference code is assigned.

Species and collection details

When you select a source such as a collection event, plant or seed accession, the species and collection details will automatically be available.

If the source does not have a species associated with it, for example when selecting a Donation, you will be asked to provide a species name.



An example source where the species name is added separately. This is because in this case, the sample was a donation.

Assigning lab numbers

When a material source is added, a lab reference number is generated. This may be auto-assigned (see Setup options) or added manually. This lab reference is carried through all subsequent samples, extracts and libraries associated with the registered material.

Material source summary field

A summary of the material source is auto-generated and added to the Record Identification field.

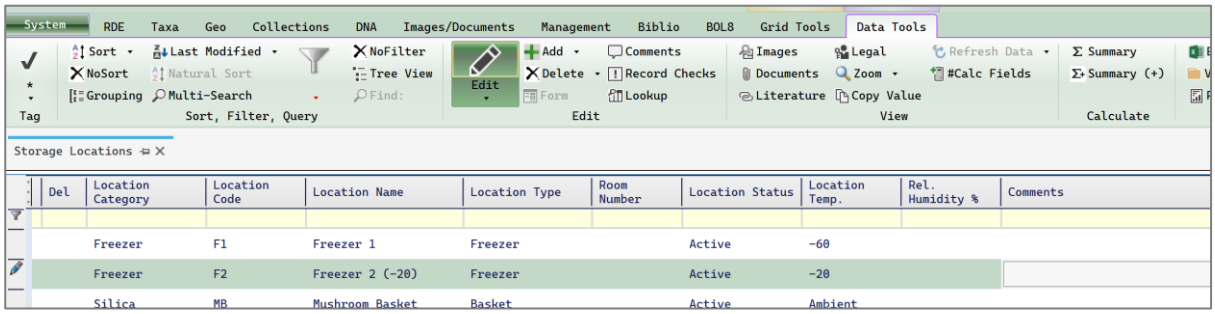
Examples:

- Plant summary: “99990154*A: Ochanostachys amentacea Mast.”
- Collection Event summary: “Waikabu, J; LAE70213; 1975;New Guinea”

Storage locations

DNA sample and extract storage locations are registered in the Storage Locations table which is opened using **DNA > Sample Materials > Storage Locations**. As well as adding the name, code, type and status for the store area, you can add the temperature and relative humidity if relevant.

These locations are used for samples and for extracts. Note that sublocations can also be stored for samples and extracts as defined in your setup options.

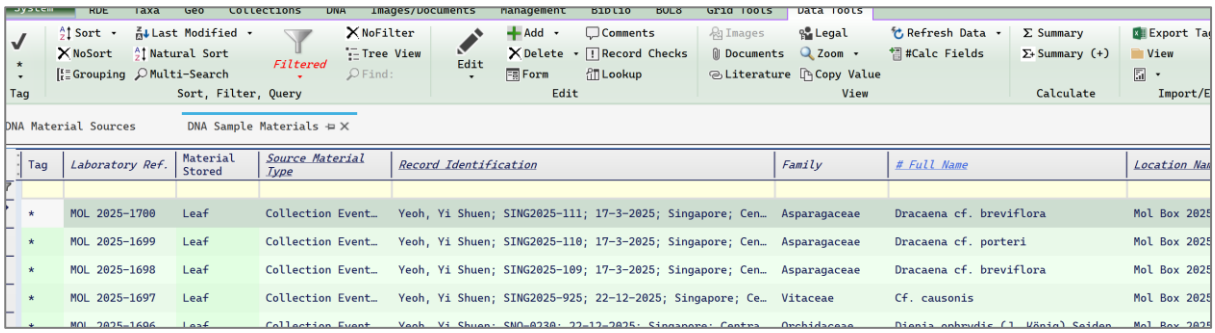


The storage location table is used for samples and extracts. Sublocations can be added in each case.

Sample materials

Introduction

The Sample Materials table is where you first register your physical samples. This includes the date stored, type of material, perhaps the quantity/units and the storage location. There may be several Sample Material entries linked to the same Material Source record. As this table is related to a Material Source record, each sample record is already linked to a species.



Sample materials example.

Adding a new sample from the start

Note. There is currently no RDE file for DNA samples and their related data.

While you could add your collection event (or another sample source) and then add a material source record before adding a sample, for new sample entries, everything can be achieved directly from the DNA Sample Materials record. Let's check the requirements. A DNA sample materials record consists of several key components.

- The source of the material.
- The type of material.
- The storage location of the material.

Note that the Laboratory reference number is assigned manually or auto-assigned when a new DNA Material Sources record is added.

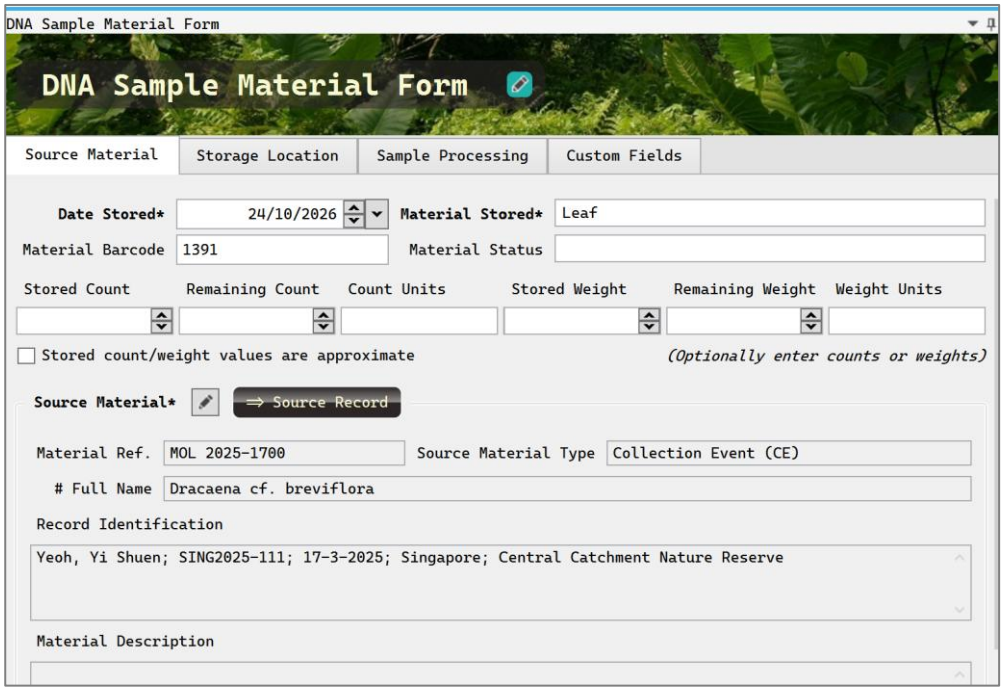
There are several ways to register a new sample – and subsequently its extract and library data. The following procedure is perhaps the most efficient way. It may seem rather complex – however, it may only take a couple of minutes to register a new sample and its origin.

A sample, perhaps based on leaf or stem tissue, is registered in the **DNA > Sample Materials** table. Open this table and select **Add**. This opens the Stored Sample Material Editor.

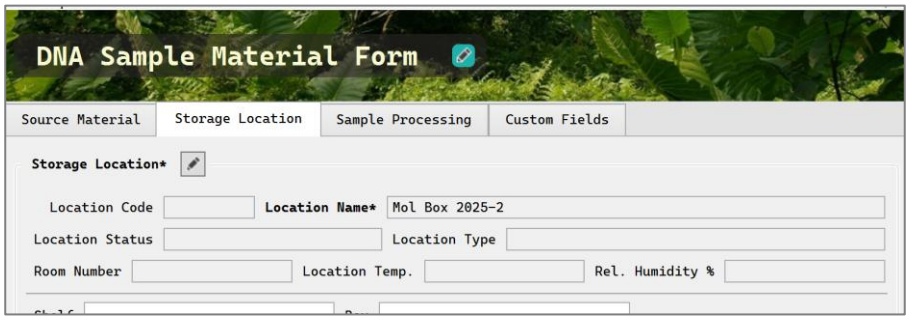
The first step is to select a Source Material entry (described above) or more likely **Add** a new one. When you select the Source Material lookup, you will see a list of existing entries. You may find the entry you want is already stored. But if not, select **New**.

- You first select your Lab name. Usually, the lookup will offer just one lab.
- Next step is to choose the **Source Material Type** from the drop-down provided. This is a fixed list of options. Select the lookup for the Linked Record Source. If your Material Type is set to Collection Event (CE), the Collection Event Selector is opened. If you select Garden Plant, the plant selector is opened.
- Continuing with the Collection Events example, if you cannot locate the collection event you want (which is very possible for new entries), you can add a new one directly here using the **New** option. This will open the Collection Event Editor. Here, using the various tabs, you can enter details for a new collection event such as the collector and number, date, location and species.

Once this stage is completed, you can then easily add the storage date, stored by and storage location details.



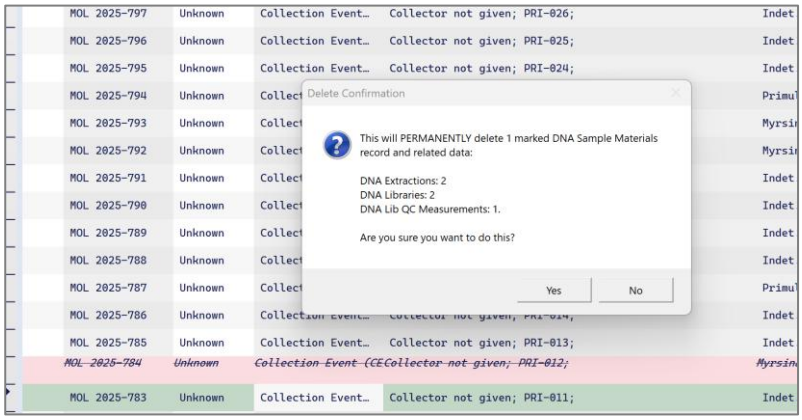
*Adding a new sample using the form. Fields marked * are required.*



*Adding a sample location details. Fields marked * are required.*

Editing and deleting samples

To edit a sample, you can use the data grid or the form. Make sure you are in **Edit** mode. Deletion is a standard process using the BRAHMS record delete option. Note that if you delete a sample, any linked extract/libraries will also be deleted. A warning is given about the consequences of record deletion.



Example warning when deleting a sample record with extract/library data.

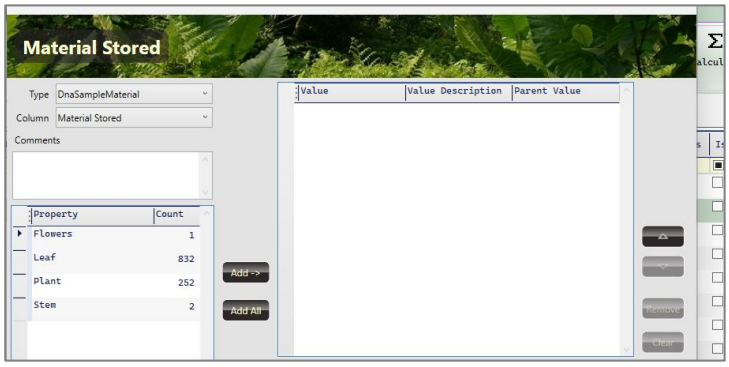
Example on how to register a lookup for samples

The principles described here can be used for other data fields where a short lookup list is required.

A good example of a lookup option for samples is the material type (leaf, stem, unknown, plant …). You can add all the entries you want not a clearly defined list of selectable options. To do this for the Sample Materials **Material Stored** field, assuming you have permissions, you can:

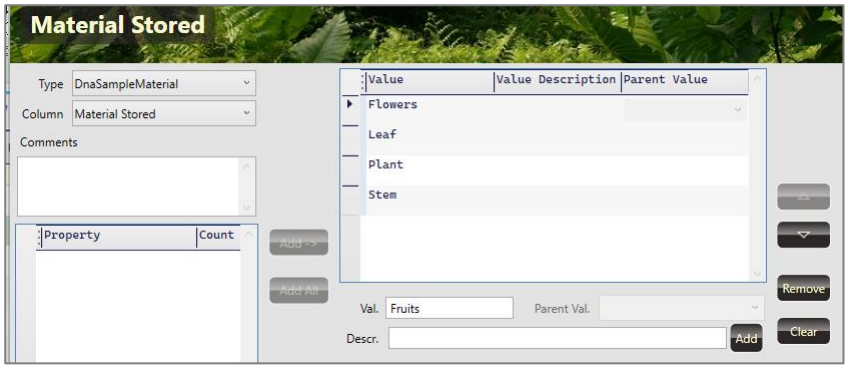
Open the Sample Materials table and go to the **Material Stored** field.

On the Edit toolbar drop-down, select **Edit Lookup Values…**

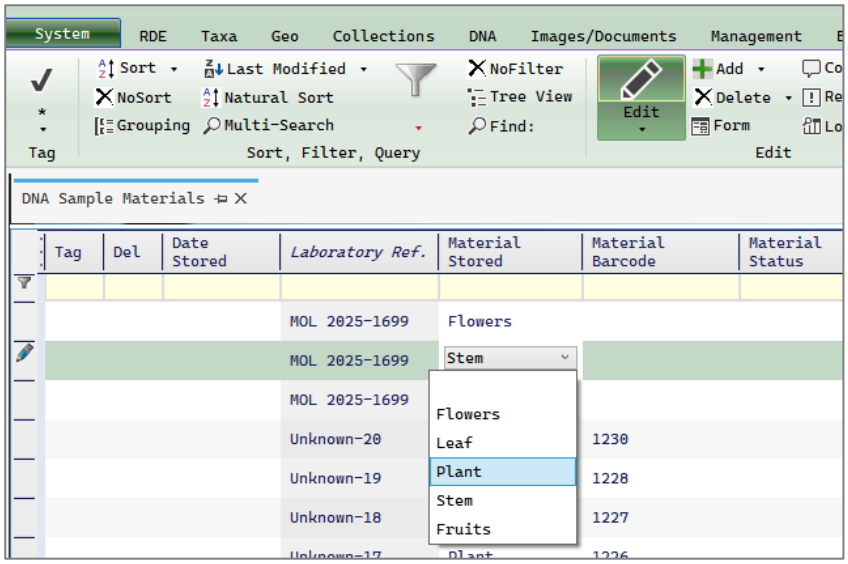


In this example, the values in the actual data field are listed on the left but none have been registered in the lookup list.

You can select some or all the entries on the left side and move to the registered look up list entries on the right. You can also add new entries to the list.



All entries are registered and a new entry is about to be added for 'Fruits'.

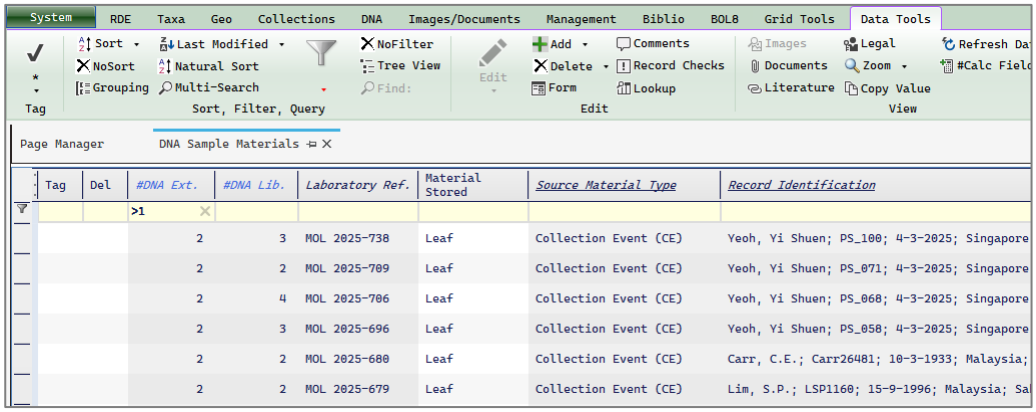


Once registered, the field becomes a lookup with a drop-down list.

Note that the lookup setting allow to force users to select a pre-defined lookup value – or allow users to select from the defined list but also to add new entries.

Note. The same lookup registration can be undertaken from the main Management menu using the Lookup Fields option.

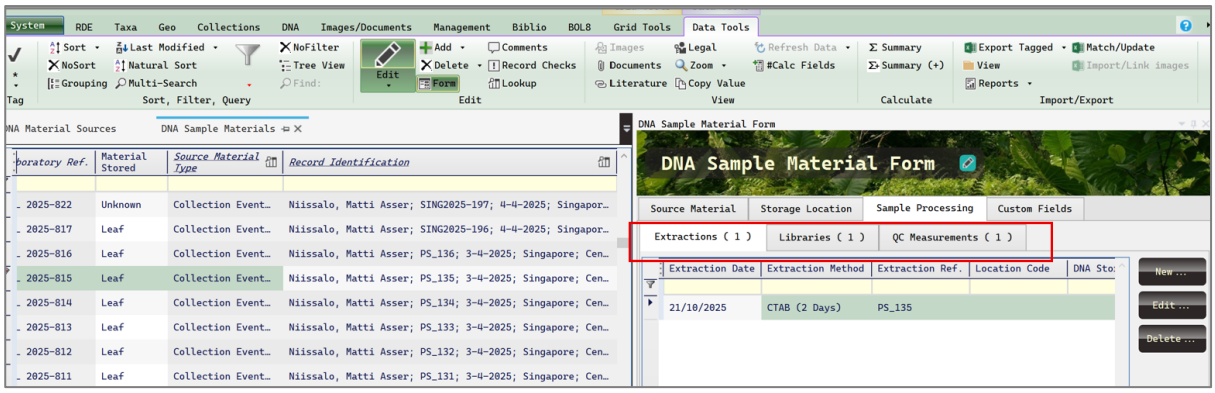
Sample calculated fields



The DNA samples table has calculated fields for the total number of extracts and the total number of libraries. In this example, a filter is set to show samples with > 1 extract.

Sample Processing summary

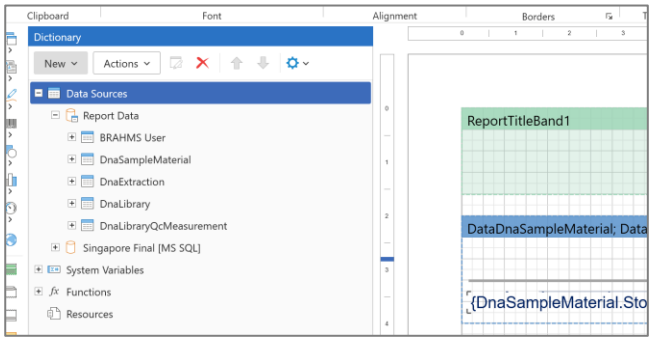
While in the sample table, you can easily get a bird's eye view of linked extracts, libraries and library measurement data.



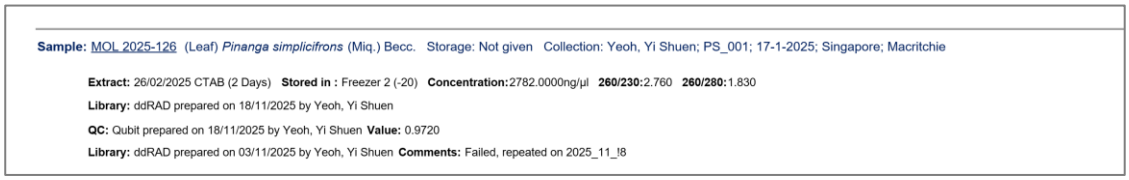
The Sample Processing tab on the DNA sample form provides tabs to view related extracts, libraries and library QC results.

Reporting from the Sample Materials table

When reporting from the samples table, the reporter provides access to data from the samples, extracts, libraries and library QC tables – allowing you to create reports that may include some or all of these data.



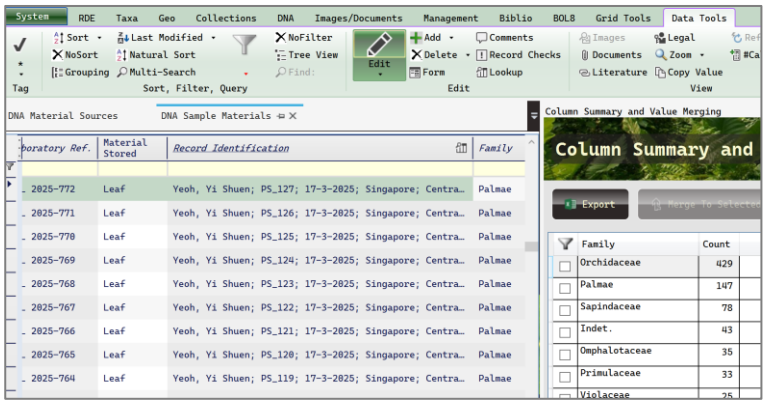
The reporter dictionary in the Samples table provides access to data from related records.



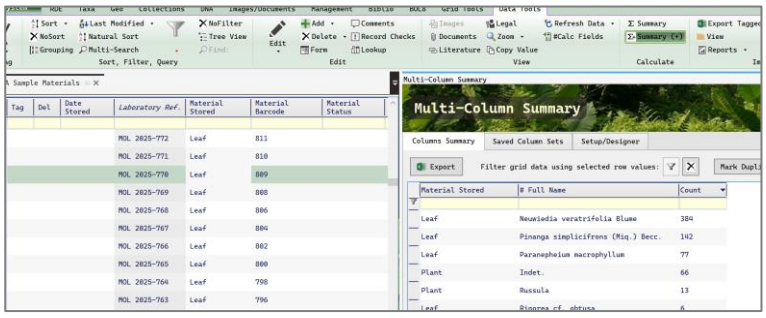
Sample of a report that includes summary data describing the processing of a sample. Reports can be designed to include any of the fields in the various tables.

Using standard BRAHMS data tools to summarize sample data

Any of the standard BRAHMS tools may be used in this (and any other of the DNA module tables.



Using the standard Summary tool to total samples per family.



Using the Summary+ tool to total samples per sample type + species.

DNA extracts

Introduction

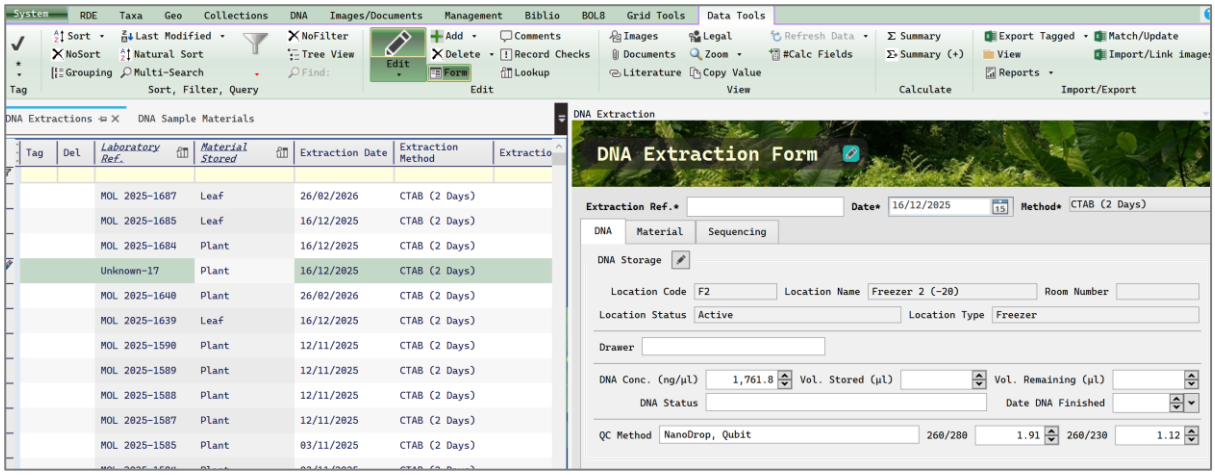
The DNA extracts table is opened using **DNA > Extracts**. This table always has a parent sample entry. Many of the fields seen in this table in fact come from the source materials and sample tables. Note that to edit the data coming from these parent tables, you need to open those tables and made the changes there. An example

would be to edit the Material Stores (e.g. leaf) which is a property of the sample and the species name which is usually a property of the collection event.

Extract data

The main fields available in the extract table that describe the extract are:

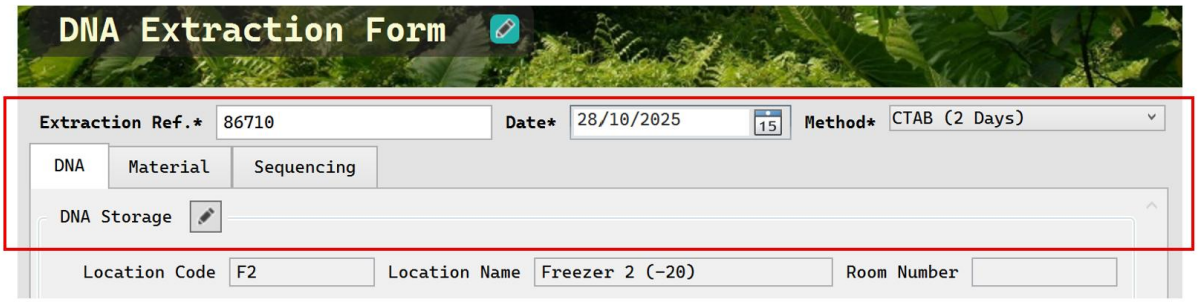
Extraction date and method; Extract reference; Storage location (and sublocation if given); Vol Stored in µL; Vol remaining in µL; DNA status; Date DNA finished; DNA Conc. (ng/µL); QC method; 260/280 and 260/230; Sent for sequencing; Sequencing batch reference; Sequenced data location 1 and 2; Genbank Accession and DOI; and Comments



DNA extract data can be edited in the data grid or using the form.

Required Extract fields

To store an extract, there are some required fields – and if these are not added, you cannot save the record. These are the extract reference (which may be e.g. a unique tube number), the date of the extract and the method used.



Required fields are the Extract reference, Date, Method and Store location.

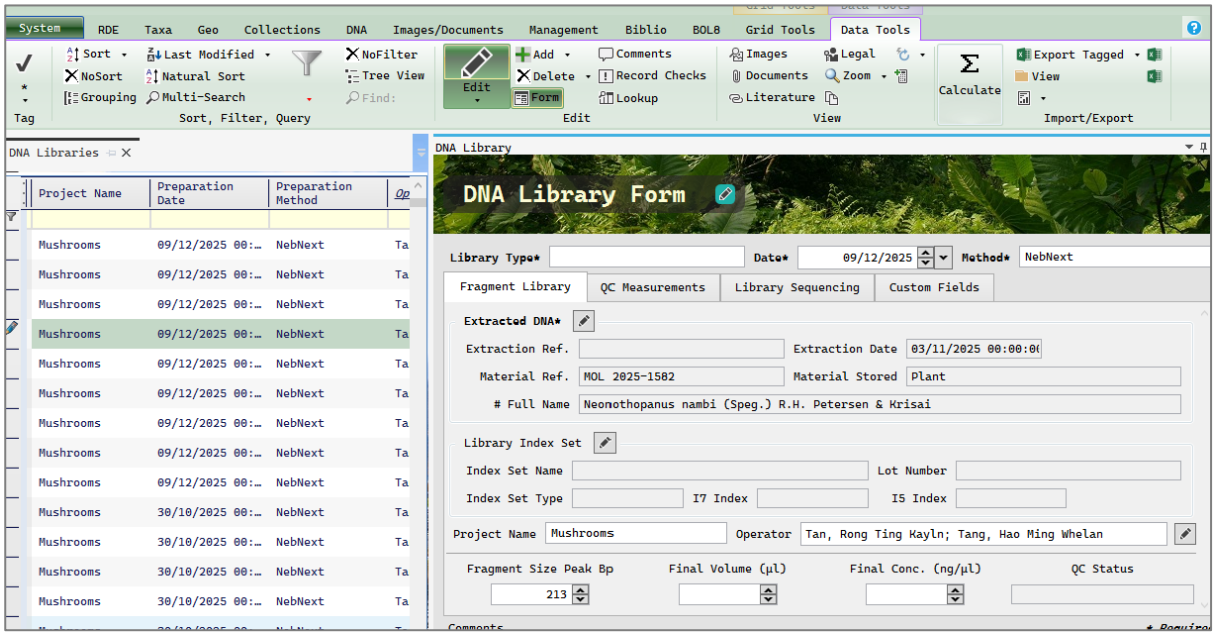
DNA libraries and QC measurements

Introduction

The Libraries table is opened using **DNA > Libraries**. Each extract may have one or more library entries. As with extracts, many of the fields displayed in this table come from parent records and those data must be edited in the relevant table. For example, the Material Stored (e.g. Leaf Sample) would be edited in the Sample Materials table. You will find that lookup options, when available, will guide you to the correct table.

Library data

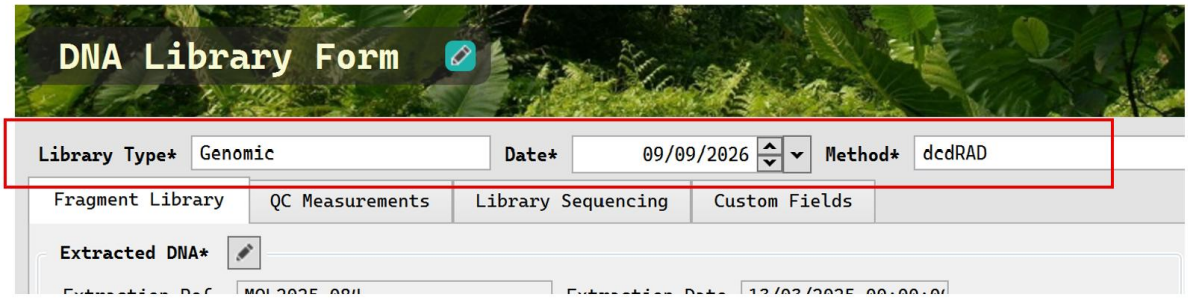
The main fields available in the library table that describe the library are: the Preparation type and Date; the Person Processing the data; the Final Conc. (ng/µL); Final Volume (µL); Fragment Size Peak (Bp); Sequencing Batch Ref.; Sequenced Data Location 1 & 2; Genbank; and DOI.



Example Library data form.

Required Library fields

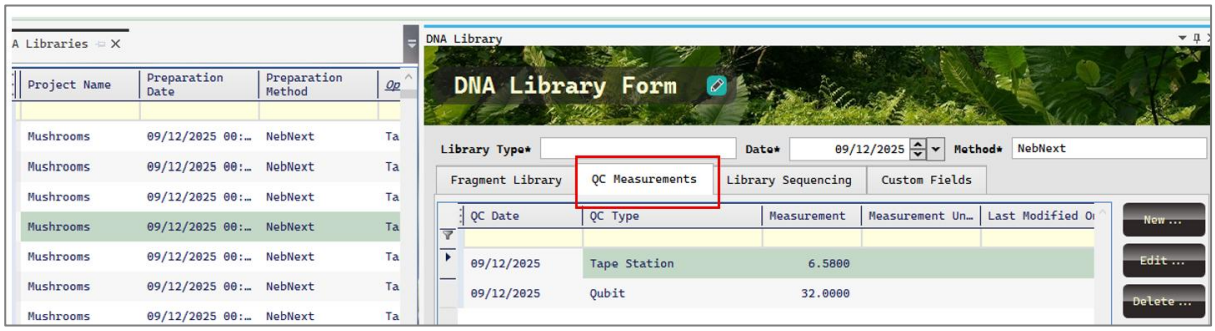
To store a Library entry, there are some required fields – and if these are not added, you cannot save the record. These are the library Type (e.g. Genomic and CDNA), the date created and the method used.



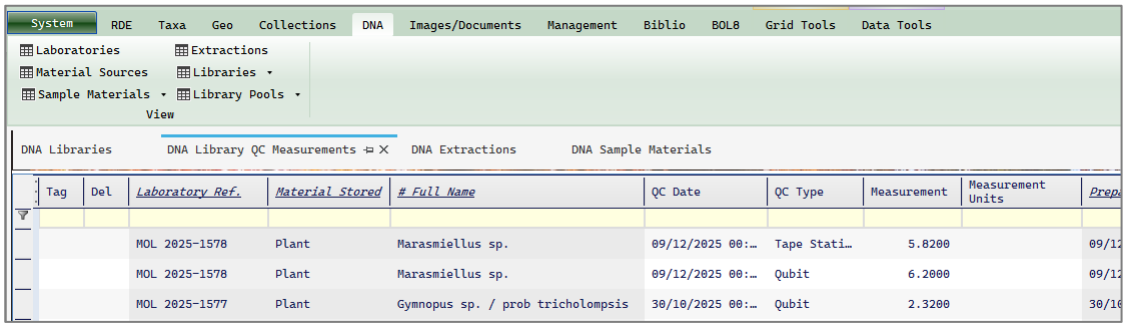
Required fields are the Library Type, Date and Method.

Library QC measurements

Library QC measurements can be added and edited from the Extract form QC Measurements tab.



Example Library data form showing QC measurement results. Data can be added and edited here.



QC measurement results can also be edited directly in the Library QC Measurements table.

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.

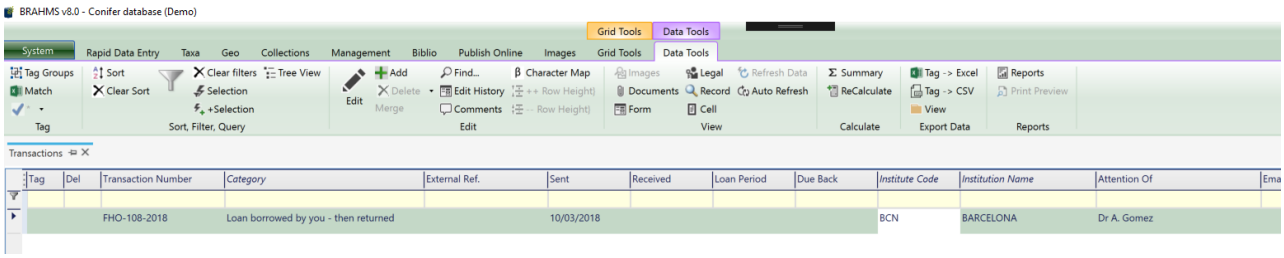
Herbaria using barcodes can make good use of these with the transaction module. Barcodes are used to select individual specimens. Barcodes:

- 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.

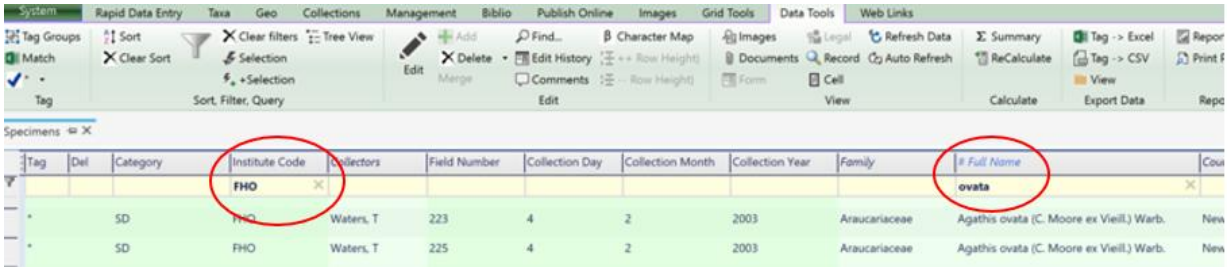
Adding a sample transaction

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 **Collections > 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 **Collections > 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.

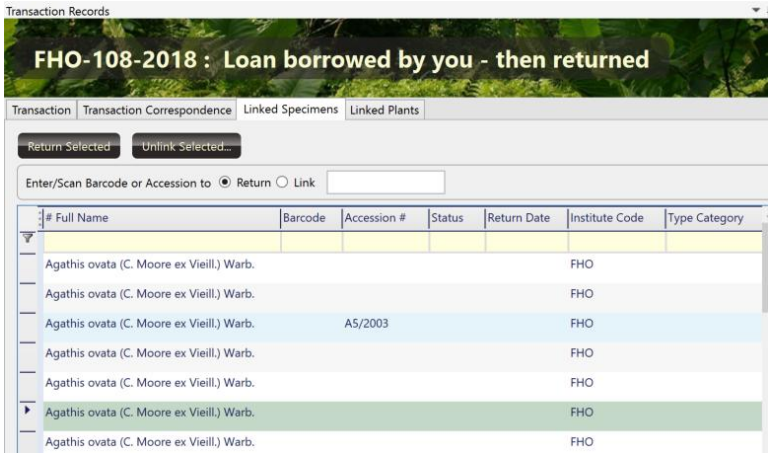


- Select **Collections** and choose the Category *Preserved Specimen* from the dropdown. You can then select **Specimens** to open that table.
- Now tag some specimens to link to the newly added transaction. You may want to use **Tag > Untag** first to ensure nothing else is tagged.



*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**.*

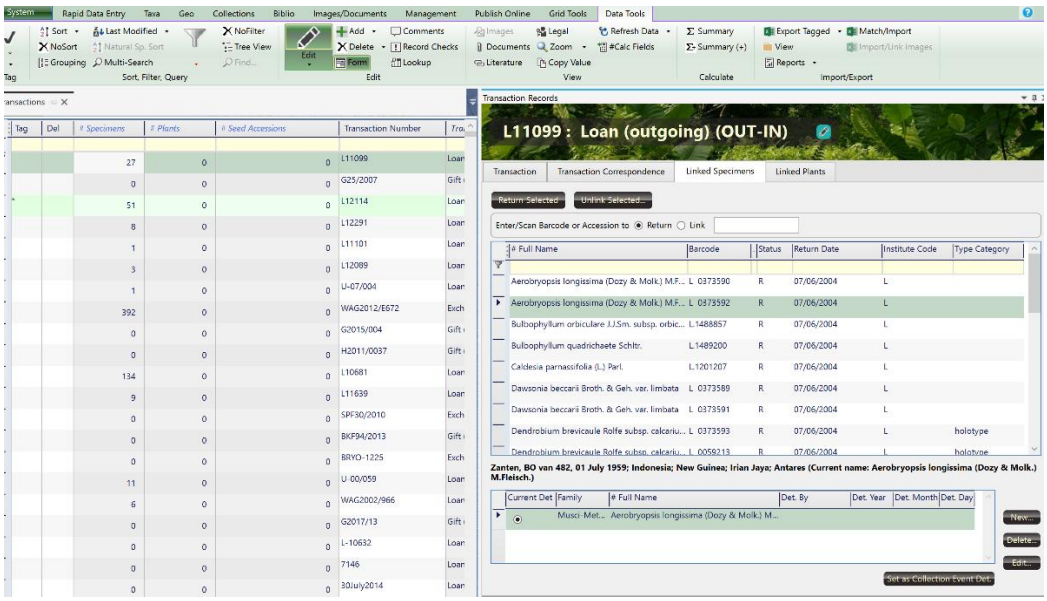
- Finally, select the main **Collections** menu again and then use the option **Tag -> Trans**. This will link the tagged material to the selected transaction. You can see the result by returning to the transaction file and opening the form on the **Data Tools** menu.



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.



An example transaction with the form opened listed linked herbarium specimens. Data provided by Naturalis, Netherlands. Options are provided to return material manually or using barcode scanning. Determinations can also be edited here.

Legal permits and permissions

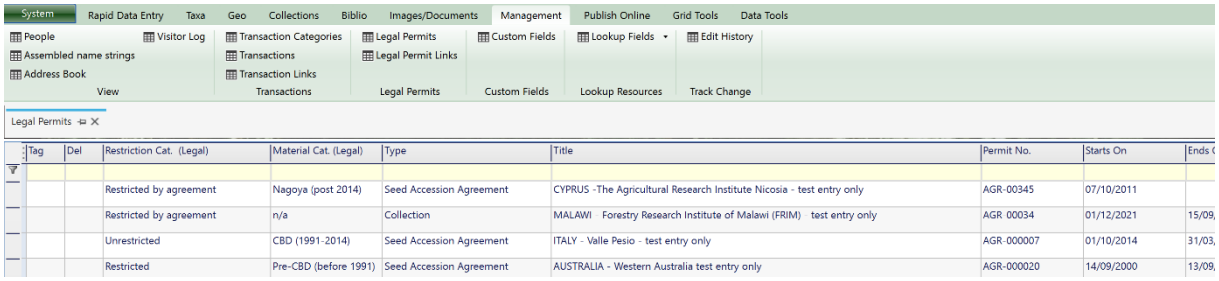
Introduction

The legal permits and permissions facilities in BRAHMS, updated in BRAHMS 8.0.10, are used to help you adhere to and document current international regulations with respect to the collection, storage and distribution of your preserved and living materials. These may be international legal frameworks such as The Nagoya Protocol or individual agreements between institutions, for example a Material Transfer Agreement or Collection Permit.

You can link multiple agreements to any record in BRAHMS together with accompanying documentation. Where relevant, the restriction status associated with an agreement is prominently displayed in your collection event, living accession, living plant and seed record data grids.

Legal permits/agreements table

This table is opened from **Management > Legal Permits**. The table has a comprehensive set of fields to add agreement details with the legal framework, agreement category and restriction status if applicable.

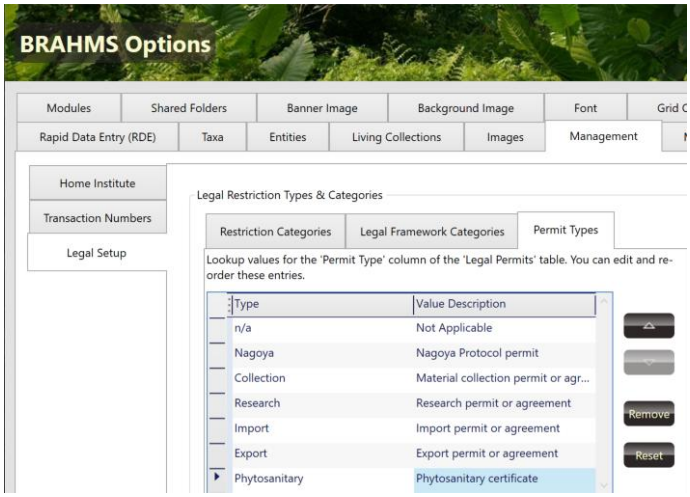


You may define any category of agreement type – examples being collection, import, export, phytosanitary, etc.

Default values for permit types and restrictions

Default Permit Categories	Default Legal Frameworks	Default Restriction Categories
• n/a • Nagoya Protocol • Collection • Research • Import • Export • Phytosanitary	• n/a • Nagoya (post 2014) • CBD (1991-2014) • Pre-CBD (before 1991)	• Restricted • Not restricted • Restricted by agreement

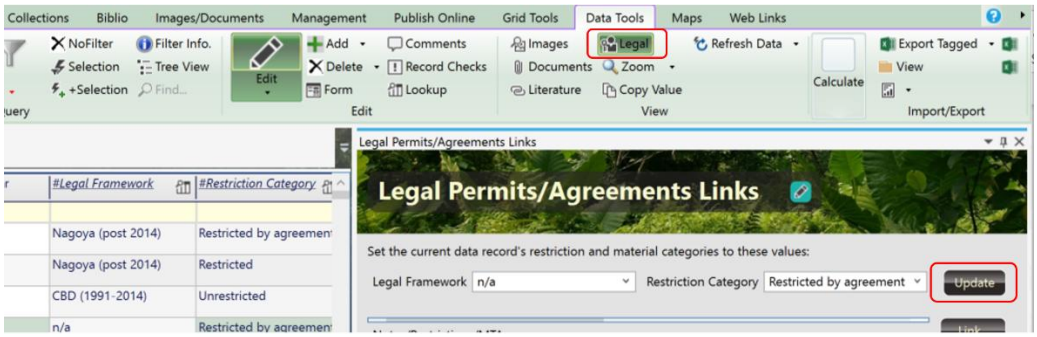
The default values provided from these lists can be edited under **System > Options > Management > Legal Setup.** As these are standard lookups, you can also edit the values in the normal way using **Management > Lookup fields**. The lookup field names are Permittype, RestrictionCategory and MaterialCategory.



The main system options form provides facilities to edit the default values for legal permits.

Assigning legal and restriction status to records

In the collection event, living accession and seed accession tables, the Legal toolbar option opens the Legal Permits/Agreement Links options. Using the top part of this form, you can select and add legal and restriction values to the current record. Use **Update** to update the record values.

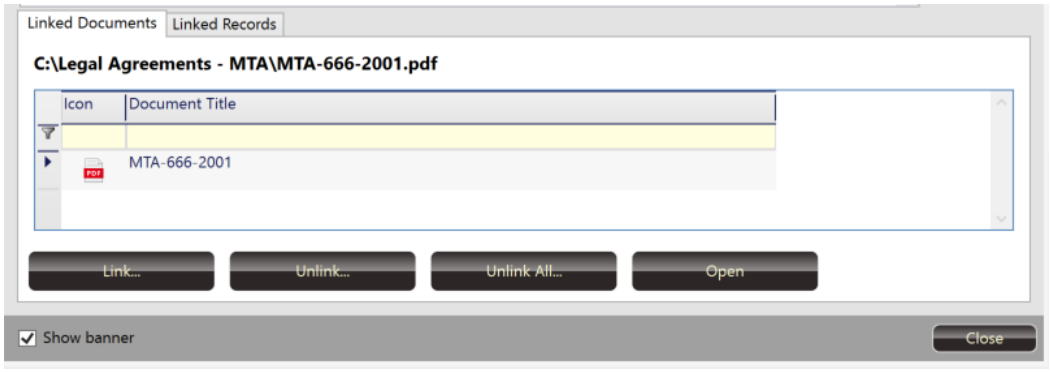


Adding agreements and related documents

On the same legal form, use the **Link** option to link a specific agreement as stored in your agreements table.



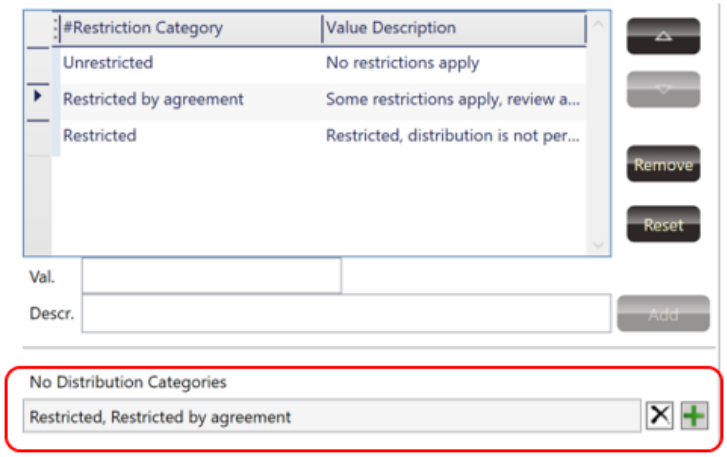
On the form, you can also add various notes fields for each linked permit. Due Diligence entries can be added for your permits and permissions entries.



In the lower part of the same form, you can link documents to the agreement records. Using the Linked Record tab, you can also link all record associated with the same agreement.

Transactions and distribution status

For each category of restriction status that you add, you can optionally assign a 'No Distribution' status. Items with 'No distribution' status cannot be linked to transactions and/or warnings, when linking materials, are given.



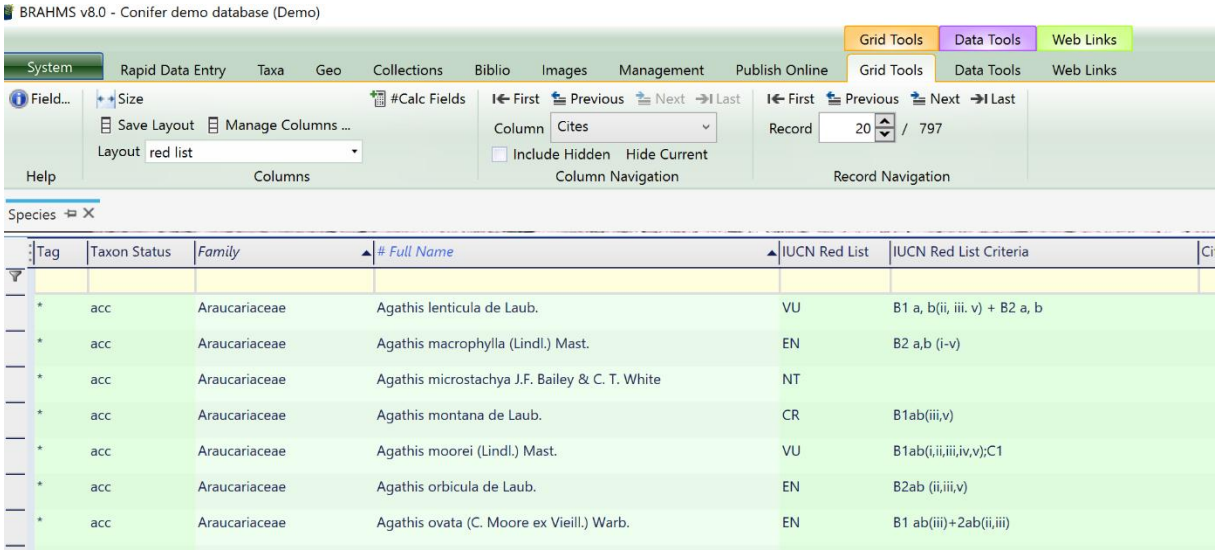
Assigning distribution status values.

The Nagoya Protocol

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/

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

Section moved to separate doc

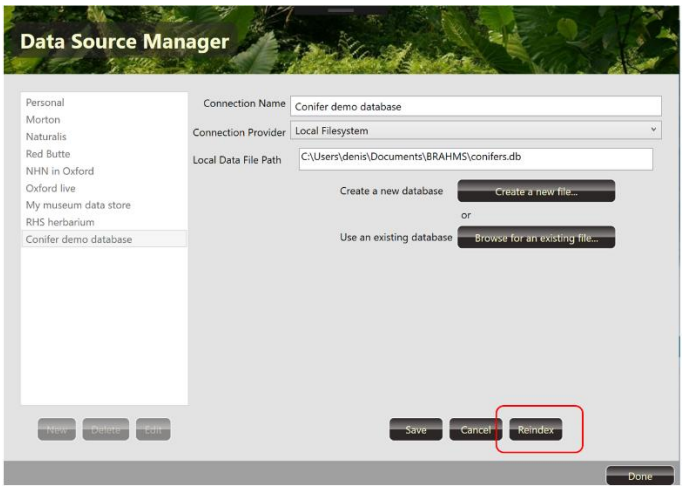
Database maintenance

Re-indexing databases

Re-indexing can increase the efficiency of a database, especially after heavy editing.

SQLite data stores

Select **System > Manage Data connections …**, highlight a local file system (*e.g.* Personal) and then select **Reindex**.



Re-index option for SQLite databases.

MSSQL data stores

Select **System > Manage Data connections …**, highlight a MSSQL data connection and then select **Reindex**.

For large databases with > a million records, we do not recommend running the reindex option from BRAHMS. Rather, you should set up a Server Agent job directly on the server. You may choose to run this task nightly. The query to run is:

```
EXEC sp_MSforeachtable @command1="SET ANSI_NULLS ON;
SET QUOTED_IDENTIFIER ON;
alter index all on ? REBUILD WITH (FILLFACTOR=80, STATISTICS_NORECOMPUTE=ON);";
GO
```

A second step updates statistics (which are used by MS server for query planning) runs:

```
EXEC sp_updatestats;
```

NB: This command cannot be run from BRAHMS – it has be executed on the database directly.

Execute the above queries against the database to optimise. This could be set to run as an automated (overnight) SQL Server Agent jobs.

PostgreSQL data stores

Select **System > Manage Data connections …**, highlight a PostgreSQL data connection and then select **Reindex**.

The commands to clean-up (vacuum) and analyze (for stats) and then reindex in PG are:

```
VACUUM ANALYZE;
REINDEX DATABASE your_ db_name_here;
```

A description of the processes to run PostgreSQL tasks are provided on many websites including as examples:

https://www.redwood.com/article/job-scheduling-with-postgres/

https://www.sobyte.net/post/2022-02/postgresql-time-task/

Backing up your data

Introduction

Please note that the BRAHMS project and the BRAHMS software itself is not responsible for backing up your data. Data backup strategy entirely depends on the individual or institution using BRAHMS. If you sub-contract data storage to a third party (e.g. cloud storage), you may engage in an agreement with that third party that includes backup. For larger organisations with an IT department, usually, the IT staff will set up scheduled, automated backups.

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 back up data but this is a much better alternative than the loss of your data.

Whether you are storing your data in SQLite, MSSQL Server or PostgreSQL, ensure you have adequate back up procedures in place. This applies to individual researchers and large institutions alike.

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 / server 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.

Overwriting backups?
Do not continually backup to the same backup file, thus overwriting the last backup. If you do this, you may end up overwriting a good backup with bad data. Select a sensible backup system.

Creating backups - which files?

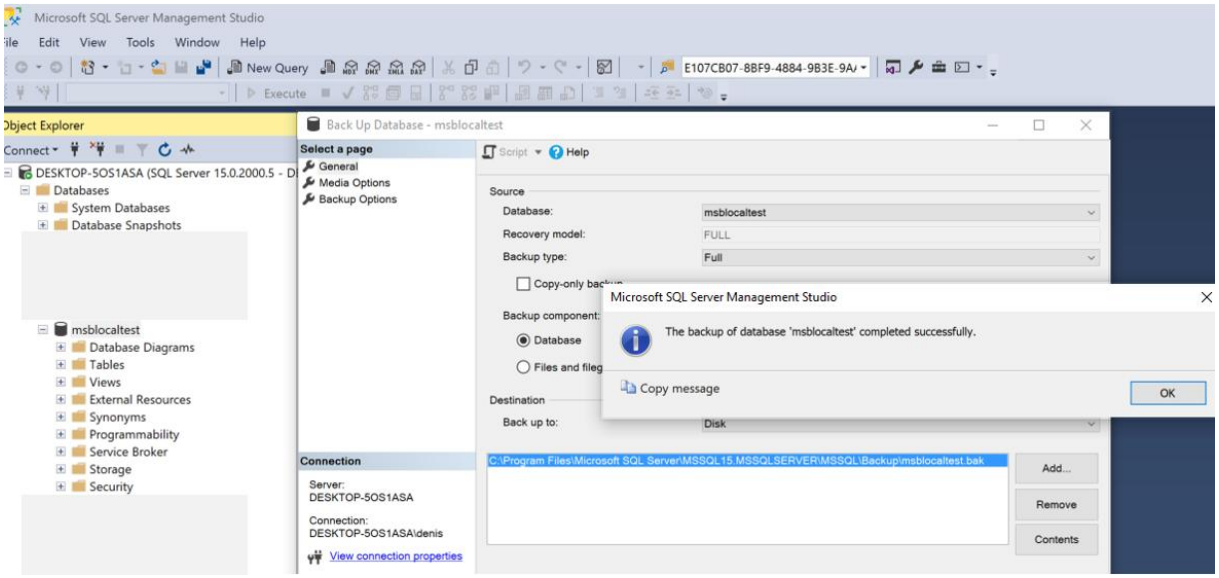
SQLite files

SQLite files can be used for BRAHMS databases and are used for all RDE files. BRAHMS SQLite files have a .db or .RDE extension. They can simply be copied to another media, optionally compressed. Your RDE files may be distributed across different folders – thus you need to make sure that all active files are backed up.

MSSQL Server – Express or Full version

If you are running the free express version, it's likely you will be responsible for your own backups. Express does not allow for automated backups in the same way that the full version does. With the full version, there are many options to create e.g. daily, overnight scheduled backups or 2-hourly backups.

Assuming you have not set up an automatic back up process, you need to use the Management Studio to create a backup. The backup is created using a right-click on your database name and choose **Tasks > Back up…** and this process will create a **.bak** file is the specified folder. The default settings will normally be adequate – thus you just need to select OK to create the bak file. There is a lot of help provided online.



The bak file you created can be compressed and then copied to your back up media.

Bear in mind the advice provided in backup rotation and frequency.

PostgreSQL

Refer to PostgreSQL documentation such as https://www.postgresql.org/docs/9.1/backup.html and https://www.geeksforgeeks.org/postgresql-backup-database/

Reporting templates and other files

When developing your back up strategy, do not forget that you have other files to cover. These may include your report templates and saved column views

Backup rotation and frequency

Do not overwrite all your backups. 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. 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.

For larger institutions, back up frequency and rotation are normally automated using automated database backup procedures. For example, there may be a requirement to set up automated backup procedures that would minimise any potential data loss to a 2-hour period.

Annex 1. Upgrading BRAHMS v7 to v8

If you:

a) have a BRAHMS v7 database to upgrade to v8 OR
b) wish to create BRAHMS 8 compatible RDE files from v7 RDE files OR
c) wish to create v8 compatible RDE file from a v7 database.

please contact brahms@biology.ox.ac.uk – and a BRAHMS team member will help you upgrade your data. There is no charge for this service.

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.

Topic	Comments
Project management	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. https://innovation.ox.ac.uk/licence-details/brahms/, https://herbaria.plants.ox.ac.uk/bol/brahms/software/purchase
Museum management	V8 is no longer restricted to botanical data. The concept of herbarium specimen is replaced by preserved specimen (= museum specimen).
Data storage	Data are no longer stored in DBF and FPT files but rather in a choice of well-known RDBMS stores that 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.
International	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.
Temp files folders	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 Documents\BRAHMS folder or as you designate with your folder settings.
Primary and foreign keys	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.
File and field names	BRAHMS v8 field names are no longer restricted to 10-characters. Table and fields names have been updated to be more meaningful and self-documenting.
Modular system	BRAHMS v8 has a flexible, 3-tiered and modular architecture opening up options for shared development. The user interface 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.
Interface	The new system uses ribbon toolbar technology (context sensitive menus and toolbars) similar to that used in MS Office applications – making it highly intuitive.
Help	Improved help is built into v8, backed up by online support and training video clips e.g. https://herbaria.plants.ox.ac.uk/bol/brahms/software/trainingvideos, https://herbaria.plants.ox.ac.uk/bol/content/software/v8/Getting_Started_BRAHMS.pdf
NULL values	It is possible to store NULL values in all tables.
Species table and field names	The fields SP1, RANK1, SP2, RANK2 and SP3 have been dropped. V8 has separate fields for species, subspecies, variety, forma, cultivar and many other standard infra names. The size limit on these fields has been increased.
Higher level classification table	A new table is added for taxon ranks above family.
Extract files	BRAHMS v8 does not have the equivalent of extract files. Instead, your selections are seen in the main tables after applying a query.
Queries and filters	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. Data grid filters provide a far simpler query approach than was available in v7.

Link file fields	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.
Lookup list	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 test entry is permitted. The values table has entries for all lookup values – abbreviations are no longer used.
Tagging	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.
Excel	V8 has much improved connectivity with Excel. You can open Excel xlsx files more easily and transfer the data into BRAHMS. You can also save data more easily to xlsx files.
Memo fields	Memo fields are no longer used. However, the text fields that replace them are effectively the same in that they store any length text strings.
Opening and docking multiple tables	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.
Dynamic web links	You can now open multiple external website links at the same time and these will auto update as you scroll through your data grid.
Mapping	In addition to the v7 mapping options, v8 includes has 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.
RDE	Rapid Data Entry (RDE) files continue as portable and flexible flat files for data transfers and capture. RDE files are now single file SQLite mini-databases. Unlike v7 RDE files, you cannot delete fields although you can alter their visibility. You can add custom fields.
BRAHMS online	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.